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EFFICIENT SURGICAL SERVICE FOR THE WHOLE COMMUNITY[1]

By Dr. ROBERT B. GREENOUGH

BOSTON, MASSACHUSETTS

UNDER its broad charter the American College of Surgeons has brought about outstanding improvements in the practise of surgery in the twenty-two years of its existence. It has set up qualifications for fellowship to ensure that every fellow is in fact worthy and competent to practise his designated branch of the art of surgery. Through its hospital standardization department and its special committees, the quality of hospital service and of surgical service supplied to the community has been greatly improved.

Profound changes, however, have been taking place in our civilization in the past twenty years. The mechanical age, with its mass production methods and the unprecedented advances of science, have brought new problems in political economy and have forced us to discard many of our older methods and ideals and to seek new patterns on which to build our economic structure.

The medical profession, however, has resisted the attempt to extend mass-production principles to the practise of medicine. It is their belief that the peculiarly personal and fiduciary nature of the relation between physician and patient is too precious to be jeopardized by radical changes of a socialistic nature. The individual is dependent on his medical adviser for the maintenance of his health and functional efficiency. In the selection of the physician or the hospital in which he has confidence rests the first step in that relationship of trust which plays so great a part in medical practise; a trusteeship—which is safeguarded by the Hippocratic oath and the code of ethics of the medical profession.

In the past five years of depression and unemployment many of the community resources formerly available for the care of the indigent sick have broken

[1] Abstract of inaugural address, Clinical Congress, American College of Surgeons, Boston, October 15, 1934.

down. This extra burden has fallen upon the medical profession to supply this service without remuneration. To this call of humanity the profession has responded, but in so doing many physicians have themselves been brought near to the level of destitution. More effective methods of supplying medical and surgical service to the community and especially to the indigent and the lower-income groups of the population, and of providing suitable remuneration for those who give this service, is an immediate and urgent necessity. Not only is this needed for the benefit of the community, but for the preservation of the community's investment in the trained medical personnel, including all the physicians, surgeons, dentists, hospitals and laboratories, nurses and technicians who are engaged in supplying medical service to the population.

This situation is of great concern to the surgeon, for the injuries and diseases which he is called upon to treat almost invariably require expensive hospitalization which not infrequently exhausts the patient's limited resources and reduces the professional remuneration to nothing more substantial than gratitude and good-will.

To the surgeon the quality of service given to the community is of supreme importance. Few of the injuries or diseases he is called upon to treat are of the self-limited class or tend of themselves to spontaneous recovery. A great part of his work also is of an emergency character and deals with acute diseases and injuries in which delay is dangerous and the moment for efficient treatment is fleeting. What must be done, must be done not only promptly but correctly, or the patient's chances of recovery may be sacrificed.

It is for this reason that the qualifications of the surgeon for the work he is to do are of such great significance. Every graduate of a medical school and every physician licensed to practise in the different states has received instruction in the general principles of surgery—in general practise the physician must be prepared to give surgical service in emergencies. The American College of Surgeons carries some 11,000 fellows on its rolls, but it would be manifestly impossible for them to do all the surgical work of the country. The emergency surgical service supplied by the general practitioner is necessary to the community and deserves the widest recognition. For major surgical service, however, prolonged training, adequate laboratory and hospital facilities and the judgment and dexterity obtained through experience are required. These qualifications fellowship in the American College of Surgeons is designed to certify.

Several other organizations exist for the certification of specialists in other lines of medical activity, but an amalgamation of all these different agencies under some central coordinating influence is to be desired in order that the qualification and certification of specialists may be national in scope and reasonably uniform in its requirements.

The hospitals of the country supply another means for determining the qualifications of specialists in the different branches of medicine and surgery through appointments to their staffs. Hospital staffs are subdivided primarily into medical, surgical and obstetrical divisions, but in large hospitals fifteen or twenty different special clinics and services are often recognized. This classification which is provided by the hospitals may well be utilized in the preparation of any plans for providing more efficient surgical service to the community, and since the hospitals themselves are an essential part of any such projects, they may well prove to be the most convenient units out of which plans for the provision of more efficient surgical service may be constructed.

It is an accepted principle that the medical and surgical care of the indigent sick is a community obligation. Only recently, and we hope temporarily, has it been necessary to call upon the state or the Federal Government for financial support of these community responsibilities.

The machinery through which these needs are ordinarily supplied includes city physicians and city and county almshouses and community and charity hospitals with medical officers on a full-time salaried basis or giving part-time service with or without remuneration. State or local public health departments are further provided to supply the community needs in the way of health-administration, sanitation, vital statistics and quarantine measures. The institutional care of the insane and of the tuberculous is also a medical activity of the local state government.

The problem of providing efficient service to the whole community is further complicated by the deplorable ignorance of the people in regard to what efficient service really implies. The sums expended annually for patent medicines and for the services of the quacks and cultists show that it is ignorance rather than economic conditions which leads people to such a waste of their resources. Knowledge of the basic facts of medical science must be more widely published and such educational campaigns must be carried on by the great national medical organizations and by the public health services of the community or of the state.

There is need, too, for further postgraduate instruction of the medical profession and, although this need is being met by many of the state medical organiza-

tions, there is yet more to do before the demands are satisfied.

From the point of view of their ability to pay for medical and surgical service there are at least three classes of the community to be considered: (1) The indigent, who can not pay at all; (2) those of adequate means who can afford to pay for what they need; (3) the intermediate group of those of moderate means who can pay for minor medical service but can not finance unaided the expenses of serious illness or prolonged hospitalization within their restricted incomes.

The care of the indigent sick is recognized as an obligation on the community, but too often this community burden is placed on the shoulders of the physician alone and he is expected and permitted to care for the indigent sick without compensation.

The physician who serves the community should not be expected to stand in any different relation from that of other professional men, such as lawyers or engineers who qualify for the public service.

This fact has recently been recognized by the Federal Government in providing and paying for the medical care in their homes or in the doctor's office of the dependents in the FERA and the CWA. This principle should be maintained.

The medical and surgical care of the well-to-do is reasonably well organized at the present time. It is the great moderate-means class of the population, however, that fails most frequently to obtain efficient service. When serious illness comes to the moderate-means patient staggering obligations in the way of debts must be assumed or the individual must lose his independence and become a burden on the community. It is to this group of the population that it has been proposed that the prepayment insurance principle be applied.

Voluntary or compulsory measures for health insurance have been instituted in many countries in the past thirty years. Some of these plans, as in Russia, involve the complete socialization and regimentation of medicine—a condition which is abhorrent to our western civilization and a form of practise which as "state medicine" is regarded as a menace to the best interests of the medical profession and of the community as well. Other plans, such as the British Health Insurance Act, involve less revolutionary changes and to this extent are looked upon with less disfavor.

For a country so large and so diversified in population and in resources as the United States it is not to be expected that any single national health insurance project should prove everywhere satisfactory. The problem is at present essentially a local one to be studied and solved by the members of the individual communities and by trial and error, if by no other means. In these experiments the medical profession must take the lead.

The prepayment insurance principle appears to be in fact about the only way in which those of the moderate means group can be expected to pay either the hospital or the physician for the medical and surgical services they need. Such projects as have been started experimentally have been restricted to relatively small and homogeneous groups of the population. State-wide plans of this nature have not yet been put in operation. To escape the dangers of commercialism and unfair competition, plans of this sort should include all the medical and surgical agencies of the community which are qualified and willing to give this service. The college has further recommended that these plans should be "free from the intervention of commercial organizations operating for profit," in order that the maximum amount of the fund may be available for the payment of the medical, surgical and hospital service which is supplied.

The moderate-means group includes all those with incomes above the indigent class and below the "well-to-do." It would not be unreasonable, however, to make a further subdivision of this large class into two smaller groups: (1) those on the *lower level,* whose resources unaided, even on a prepayment basis, could not be expected to meet the entire cost of medical, surgical and hospital care; and (2) those of the *upper level,* who can, through periodic payments, assure themselves of sufficient resources to obtain the services they need.

The difference between the amounts which the lower-level group can pay and the actual cost of the service must be obtained from other sources. In this case, as in the case of the indigent, this responsibility must devolve first upon the community.

The upper-level group of the moderate means class can carry their own medical and surgical expenses, provided hospital accommodation and efficient medical and surgical service can be supplied to them on a minimum cost basis. Intermediate wards to provide such service have been widely developed in the last few years. Voluntary prepayment plans for hospital or even for full medical and surgical service can undoubtedly be developed in connection with such middle-rate services; but they should not be restricted to individuals or small groups. They should rather be organized as a cooperative community effort to avoid all suggestion of unfair competition.

Difficulty will be found in defining accurately the limits of these economic classes—and standards will vary in different communities. Whatever standards are adopted, however, must be rigidly enforced. Those who seek undeserved charity service at the ex-

pense of the destitute must be prevented from securing such advantages, and the enjoyment of moderate means accommodations and reduced fees should be rigidly restricted to those whose finances do not permit them to obtain the needed care in private practise.

The cooperation of other groups than the physicians is also to be desired in consideration of these plans. From the sociologists and economists much important information is to be obtained and a closer and more harmonious cooperation between these groups and the medical profession appears to be the great need of the present moment in order that each may contribute of their knowledge to the solution of perhaps the most important question which affects the physical welfare of the community in the present generation. Let us conclude, therefore, that further information must be obtained by controlled experiment in smaller communities before a wise program of action can be prepared.

The responsibility of industry to maintain adequate emergency medical and surgical service for its sick and injured employees is at present widely recognized. The Board of Industrial and Traumatic Surgery of the American College of Surgeons has contributed in no small degree to improving the quality of this service by the establishment of minimum standards for industrial surgical services, based upon the fact that proper qualifications over and above that of the state license to practise medicine must be required of those engaging in this special form of surgery.

Smaller industries and, in certain parts of the country, even those of larger size have frequently chosen to entrust the risks and expenses of industrial accidents and workmen's compensation requirements to commercial insurance companies or "carriers" organized to assume these obligations. It is not unreasonable of course to expect that the responsibility of the insurance company, under these conditions, should become precisely that of the original employer so far as goes the obligation to supply adequate and qualified surgical service in the emergency treatment of the industrial accident case, and in its subsequent supervision, to ensure that competent surgical care is given. For the moment, the most practical way to secure these qualifications is to encourage those hospitals and those surgeons who desire to do this form of surgical work to meet the minimum standard established by the Board of Industrial and Traumatic Surgery of the American College of Surgeons.

No single health insurance plan of national scope appears at present to be applicable to the conditions existing in this country. The matter is at present one for local study and experiment; in which the best medical and surgical ability in the community is needed, acting in cooperation with others qualified by their knowledge of economic conditions to join in the study of the problem.

Individuals of the lower-level income classes in the moderate-means group, for whom some support derived from the community, to supplement any possible prepayment insurance plan, may possibly be needed, are the ones for whom the provision of efficient medical and surgical service offers at this time the greatest difficulties. With further progress in health education those in the upper level of the moderate-means class may well develop an interest and a desire to participate in voluntary prepayment plans, beginning first with hospitalization alone, and extending ultimately perhaps to full medical, dental and nursing services.

It is greatly to be desired that the trial of these new methods of providing medical and surgical service to the community should be encouraged in different communities where the cooperation of the hospitals, the medical profession and others interested in the maintenance of the public health can be secured. Certain general principles which should be observed in the organization and operation of these plans have already been approved by the college. The hospital department of the college provides a ready means of securing accurate information in regard to these plans and their operation which should be utilized to accumulate facts on which future judgment may be based.

While the advantages and disadvantages of the different plans for health insurance are under investigation in this laboratory of experience, a number of other steps are immediately open to us which should be of material help in providing more efficient service.

(1) The value of the code of ethics of the medical profession in the protection of the interests of the whole population must be more widely appreciated by the public.

(2) The medical and surgical care of the indigent sick must be recognized everywhere as an obligation of the community.

(3) The segregation of hospital wards for patients of moderate means, who can and should pay minimum hospital expenses and reduced fees, should be more widely practised.

(4) Abuses of hospital charity by those who can afford to pay must be prevented.

(5) The expansion of the activities of public health departments into the clinical field should be restricted to demonstration clinics for educational purposes; and to such other activities as can be made available to the community only by the use of public funds.

(6) The education of the public in regard to health matters and the postgraduate instruction of physicians should be more widely developed, and finally

(7) The quality of service supplied to the community should be recognized both by the public and by the medical profession as the first and most important consideration in every plan for providing more efficient surgical service and making it available to all classes of the population.

SOME HIGH LIGHTS OF ASTRONOMY DURING THE PAST YEAR[1]

By Dr. HARLOW SHAPLEY
DIRECTOR OF THE HARVARD COLLEGE OBSERVATORY

THE year has been well illuminated astronomically. High lights appear in India, Switzerland, Austria, Italy, Germany, Princeton, Arizona, Pasadena, Cambridge, and on Mount Palomar in California.

(1) The most talked-of star in the universe at the present time is the fourth magnitude eclipsing binary Zeta Aurigae. During the past three months it has had more powerful machinery devoted to its eclipse antics than ever before in its history or ours. Guthnick of Germany called attention some months ago to the importance of the month-long eclipse which the star undergoes three times in every eight years. Nearly three thousand observations by Miss Swope on the Harvard plates have defined the light variations closely, and in a dozen observatories over the world photometric and spectroscopic measures were made from August to October of the remarkable secret-revealing phenomena that occur at the beginning and end of the eclipse of a very hot blue star by its gigantic reddish and cooler companion.

(2) Confirmation of the great antiquity of the earth's crust comes this year from Vienna through work by Miss Kroupa on the radio-active properties of ancient rocks from Canada; she confirms earlier work on related rocks of the pre-Cambrian in getting an age of 1,725,000,000 years; the forming of the crust must have been much earlier.

(3) A new theory of relativity, which takes care of Einstein's corrections to Newtonian theory, but does not abandon Newton so completely and does not demand an exploding universe, has been advanced by the chief judge of the High Court of Allahabad in India, the Honorable Sir Shah Mohamet Suleiman. The judge is also vice-president of a Moslem university and a Cambridge-trained mathematician of high ability.

(4) From Mount Wilson and Harvard come extensive contributions to knowledge of the distribution of galaxies, and from Harvard some interesting results on the diameters of galaxies and the properties of supergalaxies.

(5) Dr. Merrill of Mount Wilson has discovered a new puzzle, and thereby makes a most important contribution to knowledge of interstellar space through finding some wholly unexplained interstellar absorption lines in the spectra of stars; interstellar calcium and interstellar sodium have long been known, but this is as yet interstellar mystery.

(6) From Princeton, Harvard, Mount Hamilton, Mount Wilson, and Flagstaff come important contributions in spectrum analysis—the discovery of methane and ammonia in the atmospheres of the outer planets, sulfur in the sun, quadruply ionized neon, not only in planetary nebulae of our galaxy but in an external galaxy, triply ionized argon in the nebulae, and in the hotter stars doubly ionized neon and argon. Coupled with these observations are some brilliant interpretations of atomic and molecular structure and behavior.

(7) Wholesale aluminizing of astronomical mirrors, replacing silvering, has gone ahead this year, culminating in the aluminizing of the Lick Observatory Crossley reflector. Silvering, in a few years, will probably exist only on the historical shelf.

(8) Equipped with an aluminized mirror Cornell sent an expedition (last summer) up the San Francisco Peaks at Flagstaff and now reports on the photographing of spectra of ninety-seven stars far into the ultra-violet, using the results to get at stellar temperatures.

(9) The Pope's observatory has been moved from his garden in the shadows of Saint Peter's to his summer place, Castel Gandolfo, well out of town, and there equipped with many new instruments which make this institution, under the direction of Father Stein, perhaps the best equipped observatory in Italy.

(10) Less than two weeks ago the California Institute of Technology purchased land at an altitude of 6,126 feet on Mount Palomar, San Diego, California, nearly a hundred miles south of Pasadena, upon which will be erected the 200-inch reflector—an important step in the decade that I fancy to call a golden age in astronomy.

(11) The day before yesterday, in Cleveland, Ohio, rough grinding was begun on the 82-inch reflector for the McDonald Observatory in Texas. On Mount

[1] Abstract of remarks at the annual dinner of the American Association of Variable Star Observers, Hotel Continental, Cambridge, 9 P. M., Saturday, October 20, 1934.

Locke, in western Texas, the Yerkes Observatory has within the past two months started operations, photoelectrically, with a twelve-inch refractor, awaiting the arrival of the new mounting next summer and of the completed mirror perhaps before the end of the next calendar year. The big piers have already been erected on Mount Locke. During the annealing of the McDonald eighty-inch mirror disk last spring, a slight crack developed at the edge. The Corning Glass Company heated the mirror again, so that residual strains as well as the crack would melt away. Happily, the weight of the reliquefied glass spread out against the hot mould—stretched it, with the result that when again the mirror was cooled they found an eighty-two-inch disk, and not an eighty-inch.

(12) Perhaps the most startling of the high lights remains to be mentioned, and it comes from a high altitude, namely the Jungfraujoch in Switzerland. Three Swiss scientists, Meyer, Schein, and Stoll, have succeeded this past summer, for the first time in history so far as I know, in detecting and measuring the passage through our atmosphere of sunlight in the far ultra-violet, λ 2000 to λ 2400, about 800 angstroms further out into the short waves than has ever been reached heretofore. The work was cleverly conceived through a knowledge of the character of the ozone layer that shelters the earth from the extreme ultra-violet light. The instrument used in the high Alps is a photon counter—not an ordinary photographic plate. The radiation that is now found to get through our atmosphere is relatively very weak, because the oxygen of the earth's atmosphere blocks most of it out—blocks it completely at λ 1800. The three Swiss scientists have opened new possibilities for high-altitude observations of the radiation from sun and stars. Aluminized mirrors have extended our front from λ 3400, approximately, to λ 2900, and now, jumping over the impenetrable ozone absorption bands of our atmosphere, we have another interval of the spectrum and another important contact with sidereal radiation, which is our chief source of knowledge of the outside universe.

OBITUARY

THE WIDOW OF CHARLES S. PEIRCE

A BRIEF notice in the *New York Times* records the passing of Mrs. Charles S. Peirce. Her age is not stated; she must have been about eighty. Her later years were a pathetic epilogue to the tragedy of the truly great man to whose lot, with touching loyalty, she joined her own. For it is a tragedy that one who ranks in the elect galaxy of master minds should have found so estranged, so nearly excluded a place in the academic fold.

The tribute to Peirce's distinction is evidenced in the reprinting of a sheaf of his more general essays nearly a half century after they were written. Professor Morris R. Cohen brought them together under the engaging title, "Chance, Love and Logic" (1923). Below the author's name are the words, "The Founder of Pragmatism." Harvard University is publishing his philosophical and scientific works in several volumes. His contemporaries placed him "in the forefront of the great seminal minds of recent times."

Two years ago I paid a visit of respect to the widow of Charles S. Peirce, to whom I had been indebted, as were so many others, for guidance and stimulation in the logic of scientific discipline. Few remain of those who had personal contact with him in the Johns Hopkins days—his only and brief academic tenure. Mrs. Peirce lived in a spacious house on a roadside within the town of Milford, Pennsylvania. The house had been built by Mr. Peirce when he was still profitably occupied. It was ambitious in size, the top floor never completed. There, Mrs. Peirce explained after we had mounted by a disused stairway, it was planned to hold scientific conferences and house the guests who were to come to sit at the feet of the master.

I stepped carefully on treacherous floors; the sides of the building had long been open to the weather; it was all a lumber heap of unfulfilled ambitions. The entire house was shadowed in memories. Mrs. Peirce gazed at it with the pride in a life she had shared.

There were books everywhere and scientific instruments and the collections of European travel, now all covered with newspapers to keep off the dust. The furniture in the drawing-room, much of which Mrs. Peirce had brought from France, gave it the air of a deserted salon. What had been the dining room was partitioned off by a screen. In that smaller space was a bed and an iron stove, on which she prepared her frugal meals and received her only source of heat. Even in early September, the rooms were chilly. Mrs. Peirce, who had sprung from the French nobility, still retained in the midst of these ruins the dignity and distinction of an assured station in life. Her only companion was a French poodle, obediently performing his tricks when politely addressed in French; the rest, solitude and memories.

When I had inquired my way to the house, I gathered, from the gestures of the villagers, that this slight, foreign lady was considered harmless but a

strangely queer person. I learned later that during the previous winter the milkman had found her almost frozen body near the pump in the garden—her only source of water, for the plumbing in the house had long since fallen into decay; she had slipped on the ice, with no one within call to assist her. The only reply to my knock had been the sharp bark of the poodle. Presently a figure came along the roadway in a black gown of other years, with a bonnet held on with ribbons and a black lace parasol held aloft. Mrs. Peirce's greetings were cordial, her accent and manner Gallic. I had not seen her since the heyday, forty-odd years before, although we had had occasional correspondence regarding arrangements for the publication of her husband's manuscripts.

She took up the thread of the tale as though the milestones of years were but conventions. She recited the details of Mr. Peirce's Lowell lectures in Boston, which must have taken place soon after her marriage. Most of all she wanted to meet William and Alice James. A seat was reserved for her in the brilliant audience that had assembled to hear her brilliant husband. She was delighted to find that her neighbor was Mrs. James. The friendship between the two women continued long after William James and Charles Peirce had ended their labors. She told of her reception by the Eliots and of the kindness of Cambridge to her, a foreigner who knew little English.

She spoke of the illnesses of her husband; how, when the doctors had given him up, she alone, with her frail hands, had nursed him back to life. She took me to the porch which she had glassed in so that her patient could enjoy the sunny shelter. She told of his persistence in getting back to his writing, even when strength failed; she told of the tragic night when he had breathed his last. It was all as of yesterday; and so were the stories of her letters to and from her family, who could not follow the interests of her distinguished American husband. She told of her insistence that he sell her jewels, when all means had failed. It was a tale of unalloyed pride, and no self-pity; just a reminiscent joy that this privilege of sharing so great a life had been hers. And as she spoke, vividly yet with patrician restraint, I pictured a stately provincial château, where she had spent her maiden years, looking forward to the sheltered fate of gentlewomen in a richly traditioned land, and contrasted it with the deserted, memory-haunted house in a rural district of Pennsylvania. From eighteen to eighty much can happen.

It seems proper that a tribute be offered to a life of singular loyalty. I doubt whether, despite the penury, the solitude, the hardships, she would have left the scene of yesteryears where all her memories were clustered. Her husband's philosophic world was closed to her; her interests were in the gentler amenities of the fine arts of living. It was all devotion to one whom his friends, who came to be hers, regarded as of the elect. That picture of a gracious old lady in a desolate house remains with me. Her privations she accepted; she lived and passed away in the environment of her memories, in the distinction of her devotion.

It is true that much of Peirce's writings are caviare to the public, and James, who found his pragmatism in Peirce's philosophy, could speak of his "flashes of brilliant light relieved against Cimerian darkness"; yet Peirce could, when he would, command the charm of lucidity and the appeal of style. He concludes his essay on "The Fixation of Belief" in these words, expressing his devotion to the methods of science:

> The genius of a man's logical method should be loved and reverenced as his bride, whom he has chosen from all the world. He need not condemn the others; on the contrary, he may honor them deeply, and in doing so he only honors her the more. But she is the one that he has chosen, and he knows that he was right in making that choice. And having made it, he will work and fight for her, and will not complain that there are blows to take, hoping that there may be as many and as hard to give, and will strive to be the worthy knight and champion of her from the blaze of whose splendors he draws his inspiration and courage.

His widow's devotion to his memory had the same quality.

JOSEPH JASTROW

RECENT DEATHS

DR. JAMES MARK BALDWIN, formerly professor of psychology at Princeton University and the Johns Hopkins University, who since 1912 has lived at Paris, died on November 8 at the age of seventy-three years.

DR. LEWIS LINN MCARTHUR, senior surgeon at St. Luke's Hospital, formerly president of the American Surgical Association, died on November 5. He was seventy-six years old.

ELMER H. WILLMARTH, associate professor of general engineering at Iowa State College, died on October 28.

HELEN A. BISHOP, professor of home management in Iowa State College, died on November 3.

SCIENTIFIC EVENTS

HISTORIC SCIENTIFIC INSTRUMENTS

AN appeal for further space for the now overcrowded collection of historic scientific instruments under his charge was made on October 25 by Dr. R. T. Gunther in his inaugural address as reader in the history of science at Oxford. He said according to the report in *The Times:*

> It had been his high privilege and great happiness to have been allowed during the last ten years to assemble in the historic home of all the natural sciences in Oxford collections which were acknowledged to be of unique historic value to the world, and particularly to that university. If space in the Old Ashmolean building had not then been available, the greater part of those collections would certainly not have come to Oxford; some would have gone overseas, much would have been lost.
>
> His work of preservation had now been partially rewarded by the offer of the most noble and appropriate scientific gift of historic interest that any science museum in England could be offered. He referred to the offer by the Radcliffe trustees of the great astronomical instruments, the best in the world when in their prime, which for a century and a half had stood in their ancient observatory. He sincerely trusted that the university would lose no time before accepting these instruments for the accommodation of which it would be necessary to move only a relatively small stack of little-used books from the old Ashmolean buildings.
>
> The only other important Oxford collection of local scientific apparatus which was required to complete the museum for the history of science was that of Dr. Daubeny, of Magdalen College. This collection had already been offered to the university by the college, and, so far as space permitted, he had accepted the offer, but a great part could not be received unless a simple suggestion made by the late Lord Birkenhead were adopted. Lord Birkenhead had said: "The university has provided these magnificent buildings for a specific purpose. Would it not be a noble and lasting memorial to demand the restoration of its spacious room to the purpose for which it was intended?" This was also the wish of a large number of members of congregation, and the considered recommendation of a committee appointed by the Hebdomadal Council of the university. Its accomplishment would speedily relieve the congestion of the collections already in the building, and would thereby enable them to be put to the full use for educational purposes.

THE HALL OF RACES OF MANKIND AT THE FIELD COLUMBIAN MUSEUM

WITH the placing on exhibition on October 4 of sculptures by Malvina Hoffman of eight more racial types, the exhibits in the Hall of the Races of Mankind (Chauncey Keep Memorial Hall) at Field Museum of Natural History are now practically complete. Altogether the hall now contains a hundred bronze and stone studies of representative types of the races of the world. Nothing further remains for addition to the series except a head of a Beduin which will be undertaken in the near future.

The sculptures now added include a full length figure of a Navaho Indian of New Mexico, and busts of a Pueblo Indian woman of San Ildefonso, N. M., a Jicarilla Apache Indian of New Mexico, a Turk, a Carib of the Amazon Basin region of South America, an Igorot of the Philippines, a Berber of Morocco and a Toda of the Dravidian group of peoples of India. Like the other sculptures in the hall, these are all life size, made from studies of typical living models.

The exhibit was made possible by an initial legacy of $50,000 bequeathed by the late Chauncey Keep in whose honor the hall has been named, and by contributions amounting to more than $150,000 received from Marshall Field and from Mrs. Stanley Field and Mrs. Charles H. Schweppe, of Chicago.

The hall is divided into three sections, one containing the full length figures, family groups, busts and heads of the peoples of Africa and Oceania, another containing those of the Asiatic races, while the central one contains the racial representatives of Europe, the Americas and additional parts of Asia.

The comprehensive nature of the survey of mankind offered in this hall is indicated in the following brief summaries by geographical divisions:

The African section contains groups and full length figures depicting a Bushman family of the Kalahari Desert, a family of pygmies of the Ituri forest in the Belgian Congo, a dancing girl of the Lake Chad District, a Senegalese drummer and a Shilluk warrior of the upper Nile. Among other peoples represented by busts and heads are the Abyssinians, Sudanese, Dahomians, Mangbetus, Somali, Zulus, Nubians and Hamites.

Europe is represented by full length figures of a Nordic and of a Sicilian fisherman, and by busts and heads of the Mediterranean types of both Italy and France, the Lapps, the Anglo-Saxons, Bretons, Alpines, Basques and Georgians.

Asiatic types depicted in full length figures are a Vedda of Ceylon, a Kashmir of India, a Tamil tree climber of India, an Andaman Islander, a Tibetan merchant, a Chinese jinricksha coolie and an Ainu of northern Japan. Among the Asiatic peoples represented by busts and heads are the Singhalese, Arabs, Japanese and a large number of types of the diverse peoples inhabiting different parts of India and China.

The American continents are represented by a full length figure of a Blackfoot Indian, and by busts and heads representing the Eskimos, Sioux Indians, Patagonian Indians and the Mayas of Yucatan.

Oceania and Australia are represented by full length

figures of a Hawaiian surf rider, a Solomon Islander climbing a tree, a Semang pygmy of the Malay Peninsula, an aboriginal Australian man, woman and boy, and a group depicting types of Madura, Borneo, Java and Bali. Busts and heads represent the Dyaks of Borneo, Sakai and Jakun Malays, the Samoans and the Javanese.

A revised edition of the pamphlet, "The Races of Mankind," by Henry Field, assistant curator of physical anthropology, dealing with the exhibits in this hall and with the subject in general, has been issued by Field Museum Press.

GRANTS IN AID OF RESEARCH OF THE AMERICAN ACADEMY OF ARTS AND SCIENCES

THE American Academy of Arts and Sciences, at its meeting of October 10, 1934, announced grants-in-aid from the Permanent Science Fund as follows:

To Dr. Joseph A. Cushman, director of the Cushman Laboratory for Foraminiferal Research, Sharon, Mass., $300 to assist in his work on the foraminiferal fauna collected by the ship *Atlantis* of the Oceanographic Institute.

To Drs. C. V. Green and C. C. Little, Roscoe B. Jackson Memorial Laboratory, Bar Harbor, Maine, $750 for the care of experimental animals and the preparation and study of microscopic sections of tumors in their work on cancer research.

To Professor Willem J. Luyten, associate professor of astronomy, University of Minnesota, $250 to assist in an investigation of the proper motions of faint stars in the southern hemisphere.

To Professor Bret Ratner, clinical professor of pediatrics and lecturer in immunology, New York University and Bellevue Medical College, $375 to aid in his experiments on asthma in the guinea-pig.

To Dr. Roberts Rugh, Hunter College, New York, N. Y., $100 for the purchase of material needed for the study of induced ovulation and egg transport in the Urodeles, and for the preparation of moving picture films of this process.

To Mrs. Mabel Ruttle-Nebel, New York Agricultural Experiment Station, Geneva, N. Y., $300 to assist in her study of the chromosome matrix in plants of Allium, Crepis, Hordeum, Tradescantia, and Zea under various temperatures and nutritive conditions.

To Professor Karl Sax, associate professor of plant cytology, Harvard University, Cambridge, Mass., $250 to assist in his study of the effect of variations of temperature on certain cytological processes.

To Professor Harry R. DeSilva, professor of psychology, Massachusetts State College, Amherst, $100 for electrical apparatus needed in his study of metabolism, and

To Mr. V. M. Slipher, director of the Lowell Observatory, Flagstaff, Arizona, $750 to aid in his work on the spectra of the planets.

Applications for grants-in-aid from the permanent science fund of the American Academy of Arts and Sciences should be addressed to Professor E. M. East, Bussey Institution for Research in Applied Biology, chairman of the permanent science fund committee, Forest Hills, Mass.

SIGMA PI SIGMA CONVENTION

THE third triennial convention of Sigma Pi Sigma was held at Purdue University on October 11, 12 and 13. Several significant questions of national policy were altered, in addition to an unusually extensive program of invited scientific papers. The title "fraternity" was dropped from the name, the association being designated in the future by the term "society." This was thought to be more in keeping with the nature of the society, which has always been an honorary and professional physics organization. At the same time all features involving secrecy were eliminated and additional emphasis will be placed upon the professional objectives of the combined local groups. The society now has a total membership of over 1,400 with about 500 active members in its 27 chapters.

Plans were approved for assisting each initiate to become a member of one or more of the professional physical societies and to encourage subscriptions to their magazines. A subsidy from the national treasury was provided for the purpose of assisting the chapters in bringing in outside speakers for open meetings.

The scientific papers included the following:

Dr. M. N. States, Central Scientific Company, "The Uses of Graphs in Physics."
Dr. I. Walerstein, Purdue University, "New Types of Demonstration Experiments" (with demonstrations).
Dr. H. C. Robertson, Purdue University, "Gyroscopes and Boomerangs" (with demonstration).
Dr. Otto Stern, Carnegie Institute of Technology, "Wave Properties of Molecular Beams."

At the close of the convention the following officers were elected: *President,* Dr. R. C. Colwell, West Virginia University; *Vice-president,* Dr. D. W. Cornelius, University of Chattanooga; *Executive Secretary,* Dr. Marsh W. White, The Pennsylvania State College. Those elected to the council were: Dr. M. N. States, Central Scientific Company; Dr. R. B. Abbott, Purdue University; Dr. J. C. Stearns, University of Denver, and Professor F. A. May, St. Lawrence University.

THE CLEVELAND MEETING OF THE NATIONAL ACADEMY OF SCIENCES

As has already been announced in SCIENCE, the autumn meeting of the National Academy of Sciences will be held on Monday, Tuesday and Wednesday, November 19, 20 and 21, at the Case School of Applied Science and Western Reserve University. The scientific sessions on Monday and Wednesday will be held in the lecture room of the physical lab-

oratory of the Case School, and on Tuesday in the amphitheater of the institute of pathology of the university. There are forty-one papers on the scientific program.

Dr. Harlow Shapley, director of Harvard College Observatory, will give on Monday evening an address entitled "Variation and Evolution among the Stars." This lecture is complimentary to the citizens of Cleveland, and the public is invited. The dinner for members and guests, including ladies, will be held at Wade Park Manor on Tuesday evening. Dr. W. W. Campbell, president of the academy, will preside and will make a short address. There will be short addresses by President Leutner, of Western Reserve University, and by President Wickenden, of the Case School of Applied Science. The Mary Clark Thompson Medal, awarded for important services to geology and paleontology, will be presented to Charles Schuchert of Yale University. The presentation and address will be made by Dr. David White, chairman of the committee on the Mary Clark Thompson Fund, and the response will be made by Dr. Schuchert. Teas, complimentary to members and guests, will be given in the Cleveland Museum of Art and the Hamann Museum, School of Medicine, Western Reserve University.

The various laboratories and museums of all departments of Case School of Applied Science and of Western Reserve University will welcome visitors at any time during the meetings. Special invitations have been extended to members and guests by the directors of the Cleveland Museum of Art and of the Natural History Museum.

Upon special invitation, arrangements have been made for three optional visits on Wednesday afternoon. These are:

(1) The Warner & Swasey Company, 5701 Carnegie Avenue. Members and their guests are invited to visit the works of The Warner & Swasey Company. Machinery, including turret lathes, will be shown both in operation and in process of manufacture. Astronomical equipment will likewise be shown including a scale-model and parts of the MacDonald telescope for the University of Texas. A feature will be the Optical Shop where the 82-inch mirror and a 58-inch flat are being ground.

(2) Research Laboratories of The Cleveland Clinic Foundation, 2040 East 93rd Street. The following demonstrations will be on view: 1. Two methods for the detection of mitogenetic radiation: a. Geiger electron counter. b. Yeast method. 2. Measurement of Roentgen Rays and Gamma Rays in "roentgens." Demonstration of instruments. 3. Emission of radiation during the oxidation of proteins measured with: a. Thermopile and radiation filters; b. Photocell and amplifier. 4. Methods of preparing and assaying the hormones of the pituitary, of the thyroid gland and of the gonads. 5. Studies in the comparative anatomy of the energy system.

(3) Nela Park, The General Electric Company. Nela Park is located just south of Euclid Avenue, three and a half miles east of University Circle. There will be visits to the Lamp Development Laboratory and the Engineering Laboratories of the Incandescent Lamp Department of the General Electric Company and to the General Electric Institute. The institute includes demonstrations and displays of the most recent developments in lighting practise for all purposes and displays of new electrical equipment for the home. A visit to the glass-bulb factory of the General Electric Company, a short distance from Nela Park, will conclude the program.

If desired, arrangements will be made upon request at the registration desk, so that individuals may, by shortening the time of stay, visit two of these institutions on Wednesday afternoon. Those desiring transportation are requested to register for the visit selected before noon of Wednesday.

SCIENTIFIC NOTES AND NEWS

DR. LEO H. BAEKELAND, honorary professor of chemical engineering at Columbia University, will receive the degree of doctor *honoris causa* of the faculty of applied science of the Université Libre, Brussels, at the centenary celebration of the university on November 19.

AT the meeting of the New York Academy of Medicine on November 8 honorary fellows were elected as follows: Dr. William Henry Howell, formerly director of the School of Hygiene and Public Health of the Johns Hopkins University; Sir Humphry Davy Rolleston, from 1925 to 1932 Regius professor of physic at the University of Cambridge, vice-president of the British Medical Association and a past-president of the Royal College of Physicians; Dr. August Krogh, professor of animal physiology at the University of Copenhagen; Dr. Claude Regaud, of the Pasteur Institute and the Curie Foundation, and Dr. Frederick George Novy, professor of bacteriology at the University of Michigan and chairman of the executive committee of the Medical School.

THE Chemical Industry Medal for 1934 was presented on November 9 to Dr. Floyd J. Metzger, vice-president in charge of research and development of the Air Reduction Company and director of research of the U. S. Industrial Alcohol Company and of the U. S. Industrial Chemical Company, in recognition of the valuable results of research in the field of gases, which has been carried out under his direction. Dr. M. C. Whitaker outlined the accomplishments leading

to the award, and Dr. Arthur D. Little, of Cambridge, Mass., presented the medal in behalf of the Society of Chemical Industry, of which he is a past-president. Dr. Metzger's medal address was entitled "Traces from Tons."

THE Cardinal Newman Award of the Newman Foundation was presented on November 7 at the University of Illinois to Dr. Robert A. Millikan, of the California Institute of Technology. Dr. John A. O'Brien, director of the foundation, presided. The citation read: "The Cardinal Newman award is conferred each year upon some person who has rendered some contribution to the enrichment of human life. For recognition in the field of physical science the Newman award is hereby conferred upon Robert Andrews Millikan." This is the first time that the award, established in 1929, has been made to a scientific man.

DR. FREDERICK MARK BECKET, president of Union Carbide and Carbon Research Laboratories, Inc., has been elected to honorary membership in the Electrochemical Society "for conspicuous service to the advancement of electrochemistry."

THE Flavelle Medal of the Royal Society of Canada was presented at the recent annual meeting to Louis Vessot King. M. Gérin, in making the citation, said: "The Flavelle Medal is awarded to Louis Vessot King, the most brilliant mathematical physicist that Canada has produced. Dr. King was born in Toronto in 1886 and educated at McGill and Cambridge Universities. He was elected a fellow of this society in 1915 and a fellow of the Royal Society of London in 1924. He has been a member of the staff of McGill University since 1910 and Macdonald professor of physics there since 1920. No Canadian has displayed greater originality or versatility in his scientific work than Dr. King, for he has won international fame as a mathematician, physicist and engineer. He is a worthy disciple of the school of Kelvin and Rayleigh. Some of the fields in which he has won distinction are electrodynamics, kinetic theory, particularly in the study of the properties of solar and sky radiation and in that of the molecular scattering of light; hot wire anemometry; fog signal machinery and the numerical calculation of elliptic functions and integrals. The mathematical work of Dr. King is characterized by the elegance and economy of the methods used."

DR. MARSTON MORSE, professor of mathematics at Harvard University, has accepted a call to a professorship of mathematics at the Institute for Advanced Study at Princeton, New Jersey. His associates in the School of Mathematics of the institute will be the present permanent group, namely, Drs. Albert Einstein, Oswald Veblen, James Waddell Alexander, John von Neumann and Hermann Weyl.

WE regret to learn that Dr. Edwin Brant Frost, director emeritus of the Yerkes Observatory, is seriously ill at the Billings Memorial Hospital in Chicago.

DR. C. L. ROADHOUSE, head of the division of dairy industry of the University of California, has been elected president of the American Dairy Science Association, and Dr. H. A. Ruehe, professor and head of the department of dairy husbandry of the University of Illinois, has been elected vice-president; these two officers, together with the following, comprise the board of directors: O. F. Hunziker, Chicago; L. A. Rogers, U. S. Department of Agriculture; M. Mortensen, Iowa State College, and A. C. Dahlberg, editor of the *Journal of Dairy Science*.

W. STARLING BURGESS, designer of the *Enterprise* and *Rainbow*, the successful defenders in the last two international yacht races for the America's Cup, has been appointed a special lecturer at the Massachusetts Institute of Technology. Mr. Burgess, who will be attached to the department of mechanical engineering, goes to the institute for the latter part of the academic year.

DR. EARL J. KING, since 1930 assistant professor of medical research and director of the sub-department of biochemistry at the Banting Institute, University of Toronto, has become reader in pathological chemistry at the British Post-Graduate Medical School, London.

AT St. Bartholomew's Hospital Medical College, London, Dr. L. J. Witts, since 1929 assistant physician to Guy's Hospital, has been appointed professor of medicine, and Dr. Geoffrey Hadfield, since 1933 professor of pathology in the University of Bristol, has been appointed professor of pathology.

BARNET D. VAN BUREN, director of the Bureau of Plant Industry, New York State Department of Agriculture and Markets, will retire on December 1. He has served the department for thirty-four years.

DR. ALFRED A. BIELSCHOWSKY, until recently professor of ophthalmology and chief of the eye clinic at the University of Breslau, plans to spend six months in research on abnormalities of vision in the department of physiological optics at the Dartmouth Medical School.

DR. CHESTER W. EMMONS, associate in mycology at Columbia University, is spending the winter at the School of Tropical Medicine at San Juan, Puerto Rico, investigating the various pathogenic fungi. Dr. Emmons, in collaboration with Dr. Arturo L. Carrión, will be especially interested in cromoblastomycosis and other rare dermatological conditions that occur on the Island of Puerto Rico.

PROFESSOR GEORGE PLUMER BURNS, head of the department of botany at the University of Vermont, has been granted six months' leave of absence. He has left for an extended trip through the southern and central United States, after which he plans to carry forward his work on chlorophyll at the University of California.

DR. JOHN CHORNYAK, of the Graduate School of Neurology and Psychiatry of the University of Pennsylvania, will be a laboratory guest of the Wistar Institute of Anatomy during the coming year. He plans to make a study of the cell layers of the cortex in the series of human brains in the collection of the institute.

PROFESSOR A. L. MELANDER, head of the department of biology at the College of the City of New York, has leave of absence which he plans to spend as a guest investigator at the University of California Citrus Experiment Station at Riverside.

DR. HARRY S. LADD, research associate in geology at the University of Rochester, has returned after completing seven months' field work in the Lau Islands (eastern Fiji). A report on the geology of the area studied will be prepared during the coming year.

THE Cutter lecture on preventive medicine was given by Dr. Charles Sidney Burwell, professor of medicine at the Vanderbilt University School of Medicine, Nashville, on November 8, at the Harvard Medical School, Amphitheater Building E. The subject was "The Prevention or Postponement of Death from Heart Failure."

DR. J. PARSONS SCHAEFFER, professor of anatomy and director of the Daniel Baugh Institute of Anatomy of the Jefferson Medical College, gave a lecture on the Schiff Foundation at Cornell University on November 2, on "Human Constitution and Some of Its Practical Problems."

DR. GUSTAV EGLOFF, director of research of the Universal Oil Products Company, will deliver a series of lectures before five local sections of the American Chemical Society on successive days beginning on November 26 as follows: University of Kentucky, "Modern Refining and Products from Crude Oil"; Vanderbilt University, "Synthesis in the Oil Industry"; University of Tennessee, "Motor Fuels and Lubricating Oils"; Kingsport, Tennessee, "Modern Products from Petroleum," and Roanoke, Virginia, "Synthesis in the Oil Industry."

THE twenty-fifth anniversary of the founding of the National Committee for Mental Hygiene was commemorated at a dinner given in New York City on November 14. The program was as follows: "Twenty-Five Years of Work," Arthur H. Ruggles, M.D., presiding, president of the National Committee for Mental Hygiene; "The Beginnings," Adolf Meyer, M.D., professor of psychiatry at the Johns Hopkins University School of Medicine; physician-in-chief of the Henry Phipps Psychiatric Clinic at the Johns Hopkins Hospital; "Mental Hygiene and Education," Dr. James R. Angell, president of Yale University; "Recent Developments and Future Plans," Clarence M. Hincks, M.D., general director of the National Committee for Mental Hygiene; "Mental Hygiene and Public Health," Dr. M. J. Rosenau, professor of preventive medicine and hygiene at the Harvard Medical School; "The Cause," Dr. Jacob Gould Schurman, formerly president of Cornell University and formerly Ambassador to Germany; "Some Intimate Remarks," Clifford W. Beers, founder and secretary of the National Committee for Mental Hygiene.

THE Society of American Bacteriologists will hold its annual meeting in Chicago, Ill., from December 27 to 29, under the presidency of Dr. M. J. Rosenau, of the Harvard Medical School. The scientific program will include groups of papers on the chemistry of antigens and antibodies, bacterial allergy and pathogenic streptococci, and in food, dairy and soil bacteriology. Round-table discussions will be held on the filterable forms of bacteria, biological changes in organic matter in nature, classification of streptococci and teaching bacteriology.

THE next annual meeting of the Federation of American Societies for Experimental Biology, comprising the American Physiological Society, The American Society of Biological Chemists, the American Society for Pharmacology and Experimental Therapeutics and the American Society for Experimental Pathology, will be held in Detroit, Michigan, from April 10 to 13, 1935. Dr. F. W. Hartman, of the Henry Ford Hospital, is chairman of the local committee. The second annual meeting of the American Institute of Nutrition will be held in Detroit on April 10, preceding the meeting of the federation.

THE fourteenth annual meeting of the Highway Research Board will be held in Washington, D. C., at the building of the National Academy of Sciences and the National Research Council on Thursday and Friday, December 6 and 7.

THE annual dinner of the Linnean Society of London was held at the Hotel Washington on October 18. According to *Nature*, the president, Dr. W. T. Calman, was in the chair, and the official guests were Sir Richard and Lady Gregory, and Dr. G. F. Herbert Smith. Following the dinner, a reception was held by the president and Mrs. Calman in the rooms of the society at Burlington House. Dr. J. F. G. Wheeler, director of the Bermuda Marine Biological Station, gave a lecture, illustrated with colored lan-

tern slides, on the natural history of Bermuda. A number of zoological and botanical exhibits were shown in the library, including a series of manuscripts and printed documents, from the society's archives, relating to the younger Linnæus, and to his visit to England in 1781–82.

THE *Journal* of the American Medical Association states that a number of internships will be available on July 1, 1935, to medical students graduating in that year. There will be first-year internships, the salary of which is $79 per month plus quarters, subsistence and laundry, second-year positions with a salary of $93.25 per month plus quarters, subsistence and laundry. Applications should be addressed to the U. S. Public Health Service, Washington, D. C.

THE U. S. Civil Service Commission announces an open competitive examination for the position of junior parasitologist for the Bureau of Animal Industry, Department of Agriculture. At present there is a vacancy with headquarters at Beltsville, Md., in which the department wishes to place a woman. Both men and women will be admitted to the examination, however. The duties are to conduct research in animal parasitology, and the salary will be $2,000 a year, subject to the usual deductions. Applications must be on file with the commission at Washington before November 26.

AN expedition for the Academy of Natural Sciences of Philadelphia, under the direction of Brooke Dolan, of Philadelphia, has left Yachow, Sze-chwan Province, China, for a year's survey of zoological areas and boundaries in eastern Tibet, and the collection of birds and mammals for the Academy's Free Natural History Museum at 19th and the Parkway. Particular efforts will be exerted toward obtaining material for habitat group displays of such characteristic Tibetan animals as wild yak, wild horse, Tibetan grizzly, Ammon sheep, white-lipped stag and snow leopard. Motion picture photography of the wild game is also planned for aiding in erecting the groups, and to record wild animal behavior. Topographical surveys of several high mountain chains will also be carried on. In eastern Kuku-nor, within the great southeast bend of the Upper Yellow River, stands Amneh-ma-chin, a dazzling snow peak of unsurveyed altitude. It is the hope of the expedition to survey this peak, thought to be over 27,000 feet high. The party includes Ernst Schaefer, of the University of Göttingen, who was with Mr. Dolan on the first West China Expedition of the academy in 1931. Marion H. Duncan is with the party as adviser and caravan leader. The route planned is *via* Ts-tsien-lu to Li-tang and Batang, where the expedition will winter and establish a permanent base. The return trip is projected across country to Sung-pan, Chengtu, Chungking and down the Yangtsze River to Shanghai in the autumn of 1935. As in 1931, Mr. Dolan's party is working in conjunction with the Metropolitan Museum of the Academia Sinica in Nanking, and is receiving the cooperation of Dr. Tsai Yaen Pei, its president, and of Dr. Chi Ping, of the Science Society of China.

Nature states that the opening of the Maison de la Chimie on October 20 in Paris marks the completion of the first step towards a comprehensive scheme of centralization of chemical bibliography and other scientific activities. The Maison de la Chimie had its origin in the celebration of the centenary of Marcellin Berthelot in 1927, when a sum of twenty-five million francs was collected by international subscription. The French Government presented a historic building—the house of La Rochefoucauld—d'Estissac, rue St. Dominique, near the Chamber of Deputies. This has been reconstructed and extended to house a library equipped with the latest facilities. Large halls for meetings of scientific societies and congresses have also been provided. Indeed, this is a special feature of the project, and the opening of the building by M. Lebrun, President of the Republic, was followed by the holding therein of the fourteenth Congress of Industrial Chemistry (October 21–27). M. Jean Gérard, administrator of the Maison de la Chimie and secretary of the International Union of Pure and Applied Chemistry, hopes to develop the present center into a "Maison de la Science" where international congresses in all scientific fields can meet and be assured of the services of a staff accustomed to the organization of congresses. All those who have attended international gatherings know that the standard of efficiency with which they are run varies considerably, and that a little more attention paid to the purely technical part of their organization would often add considerably to their scientific value. We may therefore wish M. Gérard all the success that his plans deserve.

DISCUSSION

GEOLOGY AND ARCHEOLOGY AS BORDER SCIENCES

WHEN Professor R. A. Daly delivered the Silliman lectures at Yale University last winter he reminded his audience of the fact that there is a field of study which lies between the realms of the geological and archeological sciences. Professor Daly pointed out that much is to be expected in the near future from

an application of the concerted research methods of these two historic sciences and that such cooperation would prove very fruitful in helping us to decipher the story of ancient man. Probably few could appreciate Professor Daly's words as well as I could, for as a geologist I had recently experienced the disadvantages of ignorance on archeological subjects.

I had been working in Northern India and in the Kashmir Valley, sites renowned for their historic romance, when one day luck placed a most fortunate find into my hands. I had found an artifact, a stone fragment shaped by man in prehistoric times, lying *in situ*, embedded in an ancient swamp deposit. I was fully aware of the fact that I was on the trail of primitive man in the Himalayas, but being a geologist I asked myself how this find could help me to determine the age of the formation from which I had extracted the tool. To what period of prehistoric culture did it belong? To the Neolithic or Paleolithic? Quite obviously my find belonged to the latter group, for not only was it a primitive, still unfinished tool, but some stone flakes subsequently found in association with the tool indicated the existence in former times of a primitive human industry of a type which could only have flourished during the older Stone Age. Was the implement Chellean or did it belong to a younger culture, was it perhaps even late Mousterian which in Europe occurs in the interglacial strata which preceded the last ice advance? At that time I had as yet not located in Kashmir any fossil or glacial deposits which would have furnished proof of the Pleistocene age of the formation. As the find was made in the uppermost portion of a thick freshwater deposit I provisionally assumed a young Pleistocene age for the clays. I had found a guide fossil in the Pleistocene, but due to my ignorance of prehistoric cultures I was unable, temporarily, to use it for my stratigraphic work. I consoled myself with the thought that it was up to the prehistorian to determine the relative age which the tool represented within the type sequence of human industries. For the time being I decided to search for fossils and other geologic evidences which might be contained in this lake formation, and although I was more successful than my predecessors in this respect, the finds which I made were too fragmentary to reveal a complete record of the history of this lake basin. Had I known then, as I do now, that the tool belonged to an early Levalloisian type of industry which in both Europe and Africa is associated with Middle Pleistocene strata, I would have had a definite lead to guide my work in Pleistocene stratigraphy. Besides, had I been made conscious of the geological value of archeological finds I would in all likelihood have found more sites of Pleistocene man in the Himalayas.

It is the geologist's ignorance in archeological matters which causes him to miss many opportunities of contributing to one of the least known, yet most fascinating chapters of human history. A man may be an excellent field geologist and yet fail to recognize the buried traces of the human past. There are a good many incidents in geological exploration which illustrate this point. Before the war, while Professor Hans Reck was making a geological survey in East Africa, he collected some fossil bones of human origin in Pleistocene deposits. Apparently there were no artifacts in these strata and this was used as an argument against the fossil nature of the hardly mineralized skeletal remains. In 1926, Dr. L. S. B. Leakey began an organized search for Stone Age cultures in Kenya and he unearthed a complete sequence of Stone Age industries which yielded thousands of artifacts from Pleistocene beds. It was this archeological search which in 1931 culminated in the discovery of what now appears to be the oldest direct ancestor of *Homo sapiens*. The well-organized work of this expedition led eventually to a thorough study of the Pleistocene in Kenya and this in turn solved many important geological problems. Evidence was found of pluvial and interpluvial periods within the glaciated tract of East Africa and the surveying of the Pleistocene led to new conceptions of Rift Valley structures and their connection with more recent volcanism. The prehistoric finds in themselves provide new food for thought for the archeologist in Europe, and already it appears very possible that the English Pleistocene geologist will benefit from this work in distant lands.

Without the close cooperation of archeologist, geologist and paleontologist, the discovery of these oldest remains of *Homo sapiens* in the old Pleistocene of Kenya would have been impossible. In the same way it is unlikely that Peking man would have been found had it not been for the late Dr. Davidson Black's ingenious linking of the physiographer's research methods with those of the paleontologist, geologist and prehistorian. Dr. George E. Barbour's studies on the loess problem and the physiographic cycles through which the Hoang-Ho drainage system passed, must be considered as fundamental to the coming researches on ancient man in Asia. It is in this type of work that the principles of physiography can be successfully applied to prehistoric studies.

For the sake of insuring a better control of prehistoric researches, there has recently been founded a "Committee on study of early man in North America," which is under the auspices of the Carnegie Institution of Washington.

From these examples the reader may gain the impression that already everything has been done to insure greater emphasis in the geologist's field work

on prehistoric problems and to make the archeologist more geologically minded. But the cases cited are exceptions rather than the general rule. In reality we are far from taking this cooperation very seriously. How often does it not occur that an archeologist returns from South America, Alaska or India without even troubling to call on a geologist for help in clearing up problems of stratification, paleoclimatology or paleogeography? If one takes a brief look at the histories of the more important archeological excavations, such as those at Ur and Babylon, Yukatan or Mohenjo Daro in India, one is struck by the lack of accurate geological information concerning these sites which is in our possession. It would have been a matter of small expense to have a geologist study the physiographic and stratigraphic records from which the archeologist could have obtained information of a paleogeographical nature. Such neglect has already caused great opportunities to be lost, particularly in Central Asia and Asia Minor, where the sedimentary records of climatic oscillations and of physiographic changes are frequently in a very complete state of preservation. In a very recent case of cave excavations in Asia Minor where unrivalled prehistoric treasures were brought to light with the greatest skill, no geologist was at hand to keep a detailed record of the Pleistocene sediments. And yet here was a great opportunity to link the culture sequences of the older Stone Age with eustatic changes of the Mediterranean sea level which seem to have left clear traces along the coastal plain. In this case much emphasis was placed on the paleontological record, but very frequently the paleontological record in an implementiferous deposit is too incomplete to enable us to reconstruct climatic or geographic changes. Sediments very often prove to be more reliable indicators. In any case more attention should be given to the possibilities of complementing the paleontological records by detailed geological observations. How stimulating such multiple approaches can be may be learned from the work on the history of Lake Lahonton in Nevada.

Judging from my own experience it seems to me that the neglected state of this border science is in large part to blame for the very slow progress which we have made in bringing about a clearer understanding of the involved history of the Pleistocene period and of its hominid records. I even venture to say that the present dearth of knowledge concerning Paleolithic man in North America may be due in no small part to inadequate information regarding primitive human cultures on the part of the geologist. The obvious remedy for this state of affairs appears to be to place greater emphasis on the knowledge of prehistoric artifacts, particularly of the more primitive cultures. These latter, which may be conveniently grouped together as pre-Chellean industries, are rather difficult to identify as human tools, when, as so frequently happens, they occur in a gravel deposit, and it requires some acquaintance with type examples before one can identify the unmistakable marks of human manufacture. Should opportunity to study artifacts be lacking, despite the fact that all our larger museums of natural history are provided with standard sets from Europe, there is always the literary approach, either through G. G. MacCurdy's textbook or through a more recent, very stimulating book by L. S. B. Leakey, "Adam's Ancestors" (London, 1934). The latter gives a fascinating review of the geology of ancient man and serves as a vivid introduction into the various techniques of stone manufacture. So much for the geologist. If he does his part a great advance in the study of primitive man will have been made, and one can only hope that the digging archeologist will meet him half way and will no longer be satisfied to bring a few inadequate rock specimens from his site but will become conscious of the value of geology as a border science to archeology.

H. DE TERRA

PEABODY MUSEUM
YALE UNIVERSITY

PERFORATED FIBER-TRACHEIDS IN THE PASSION FLOWERS

THE stem anatomy of *Passiflora vitifolia* H.B.K. from the Canal Zone has proved to be as interesting as its scarlet flowers are striking. This plant may run as a small vine through the undershrubs or on occasion it may become a liana reaching far up into the top of the forest.

As is the usual case in such plants the vessel elements are large, measuring up to 0.5 mm in diameter. Other cells in the xylem are fiber-tracheids, septate fiber-tracheids, libriform fibers and ray cells. The fiber-tracheids vary in length from 1 mm to 2 mm, the average width being 0.03 mm. The pointed ends are long and tapering, occasionally forked at one end or at both ends. The walls have numerous bordered pits with lenticular apertures. A large proportion of these cells have perforations. In most cases they are two in number, situated near the ends. Fiber-tracheids ending in extreme points, wherein the lumen is almost non-existent, have the perforations in the wider parts of the cell from one fifth to one third of the cell length from the end. The perforations establish unobstructed passages from one fiber-tracheid to another, never apparently to a vessel element nor to a ray cell. A small percentage of these perforated fiber-tracheids have but one perforation. Probably they are the end cells in the

series. Their frequency suggests the average vertical extent of these cells in series to be five cells.

The cells in question are not to be confused with the long and narrow vessel elements of some woods nor with those vessel members which bear flap-like prolongations extending far beyond the perforation plate. Except for their perforations these cells differ not at all from the typical imperforate fiber-tracheids all about them. Since the xylem is well supplied with huge vessels it is improbable that these short series of perforated cells whose lumens are only as wide as the walls are thick would aid water transport materially.

Subsequent examination has shown similar cells to exist in all other species in our collections of the genus *Passiflora,* as follows: *P. menispermifolia* H.B.K., *P. seemanni* Griseb., *P. biflora* Lam., *P. misera* H.B.K., *P. punctata* H.B.K., *P. auriculata* H.B.K. and *P. coriacea* Juss.

ROBERT H. WOODWORTH

HARVARD UNIVERSITY

A POSSIBLE RELATION OF VITAMIN E TO UNRESTRICTED CELL DIVISION

As a result of a long series of experiments which have been carried out by the writer in collaboration with Drs. Card and Sloan, of the department of poultry husbandry of the University of Illinois, a large mass of evidence has been obtained which goes to show that vitamin E is very intimately associated with, and probably exerts an indirect controlling influence over, the nucleus of the cell during cell division.

In earlier experiments on the effects of vitamin E deficiency on the developing chick embryo, using a modification of the Waddell-Steenbock method of destruction of this vitamin by treating food with ferric chloride, remarkable conditions of tissue proliferation were encountered. It was also found that somewhat similar effects could be established in older birds under these conditions.

With this clue as a basis for further work, prolonged feeding of the treated food to chicks has resulted in the development of characteristic pathological lesions affecting the visceral organs. Histologically, these are found to represent foci of degeneration and destruction of normal tissues accompanied by replacement and invasion by new cell growths, which, in turn, appear to be derived from an undifferentiated type of tissue having the form of a delicate reticular syncytium. The whole series of effects are apparently due to a phenomenon of uncontrolled and unrestricted cell growth simulating malignancy.

A complete account of the results of this work and a possible theoretical explanation of the relation of vitamin E to unrestricted tissue growth, which will serve as a working hypothesis, will be presented in a separate article in the near future.

F. B. ADAMSTONE

UNIVERSITY OF ILLINOIS
SEPT. 19, 1934

THE CHEMICAL TRANSMISSION OF NERVE IMPULSES

MY address at Indianapolis on "Chemical Ideas in Medicine and Biology" (SCIENCE, Vol. 80, p. 343) was published so promptly that I had no opportunity of correcting a rather serious error in my statement dealing with recent work on the chemical transmission of nerve impulses. I stated (p. 347) that the weight of acetylcholine required to transmit the effect of a single nerve impulse to a single ganglion cell was of the order of 10^{-21} gram; and, as Mr. Watson Davis reports under "Science News" in the same number, I verbally emphasized this estimate before a great and distinguished audience by stating that it represented about 3 molecules of the substance. Dr. Langmuir had, in fact, had the kindly interest to make this last calculation for me just before the meeting. Not till my arrival in London did I make the humiliating discovery that the distractions of a brilliant occasion had led me into the promulgation of a gross numerical error. An important factor of 10^6 had slipped out of the calculation. The figure should have been 10^{-15} in place of 10^{-21}, and from this correct value the calculated number of molecules would have been three million, not three. The incorrect statement, as I made it, may cause some theoretical pangs to physiologists who read it, and I wish to relieve their bewilderment as promptly as possible.

H. H. DALE

NATIONAL INSTITUTE FOR MEDICAL RESEARCH
LONDON

SCIENTIFIC BOOKS

PARASITISM AND DISEASE

Parasitism and Disease. By THEOBALD SMITH. 196 pp. Princeton: Princeton University Press. $2.00.

FORMER students of Theobald Smith and medical men in general will welcome his book on "Parasitism and Disease." This work, based on his Vanuxen lectures, but expanded and with additional chapters, is presented as his "final attempt at showing the relation between disease and parasitism in its broadest manifestations." Read critically, some of the material

here presented as factual may not be generally accepted as such, but since the work is intended for a mixed audience and because of the vastness of the information drawn from various fields, a certain number of inaccuracies are to be expected. In fact, the author states "even the actual truth must now and then be strained to simplify presentation."

The concept of conflict of host and parasite as an interpretation of disease is quite acceptable and in fact is firmly established in the consciousness of medical men, but perhaps too much emphasis is given to this concept when it is applied to the entire organic world, for the relation of many organisms involve no more than competition, while beneficial cooperation is also a wide-spread phenomenon. Indeed to many biologists, the wide occurrence of mutualism and well-balanced relations may be quite as impressive.

In the chapter on "The Stage of Conflict between Host and Parasite," Smith is at his best, having wide acquaintance and extensive experience in the field covered. His review of the results of investigations in the field of immunology is most illuminating. There is that unusual capacity of surveying a great amount of material from a detached point of view rather than a rehearsal of intricate detail. Simplicity of presentation gives the reader a ready grasp of the subject. Among the many charms of this work as a whole is the avoidance of hypotheses explaining all results. On the contrary, there is a fair statement of contradictory evidence and a free discussion of many questions as yet unanswered. The chapter on epidemiology furnishes a brief but interesting review of major epidemics and a discussion of factors that play a part in such.

In the opening statements of the last chapter on the utilization of discoveries, it would appear that the author has overstressed the importance of the utilitarian objectives in research. While it is true that the outstanding figures of the last half century in the medical sciences have attacked practical problems, surely this tendency at the present time needs no encouragement. Important contributions by the older zoologists and parasitologists, such as the discovery of intricate life histories, are all but forgotten in modern medicine, but they have doubtless furnished a basis for our views on the relation of parasitism to disease. It need only be pointed out that we do not look to actuaries for outstanding creative work in mathematical problems, nor have generations of horticulturalists engaged in the improvement of the garden pea produced a Gregor Mendel.

Irrespective of whether one agrees with Dr. Smith on all points, this book will be found both stimulating and instructive. Open-mindedness is a quality sufficiently uncommon to be appreciated when encountered. The book will doubtless prove of great value to biologists and zoologists as well as to those interested in the medical sciences.

E. E. TYZZER

HARVARD MEDICAL SCHOOL

CRYSTAL STRUCTURE

A Study of Crystal Structure and its Applications. By WHEELER P. DAVEY. McGraw-Hill Book Co. 695 pages + xi. 1934.

THIS large book is intended for use as a text-book in graduate courses on the structure of crystals. In the opinion of the reviewer the book can not be considered as satisfactory for this purpose.

The subject of the structure of crystals and methods of structure determination is characterized by its inclusion of portions of several branches of knowledge with which the student of chemistry and physics is usually not familiar, such as the theory of space groups, the special geometric apparatus of the crystallographer (including extensions developed for crystal-structure applications), etc. Moreover, any one of the various procedures used in determining the structure of crystals involves a number of steps, some of which depend on logical arguments not often met in other fields of research. There is great danger that a student will become confused, and it is especially desirable that a text-book dealing with this subject be written clearly and logically and be free from errors. It is accordingly regrettable that in the book under review many of the discussions and derivations are needlessly long and complicated and marred by serious as well as minor errors. As an illustration, one chapter will be described.

The detailed discussion of the determination of the structure of representative crystals is an especially important part of a crystal-structure course. In Chapter IX, dealing with this subject, the author treats sodium chloride, calcite and tricalcium aluminate. In the treatment of sodium chloride, the unit of structure is taken as containing four molecules without discussion of the possibility of its being larger or of the evidence that should be collected against this possibility. The very important argument involving determination of the Bravais lattice is not used.

In finding the unit of structure of a crystal with the point-group symmetry of calcite, it is necessary first to find the smallest hexagonal unit which will account for all observed x-ray reflections, and then to apply the rhombohedral criterion to see whether the underlying lattice is hexagonal or rhombohedral.

It is not possible to reverse the order of these steps; yet in the discussion of calcite given in this book the steps are reversed.

The third section of this chapter deals with the determination of the structure of tricalcium aluminate from powder data, based on original work by the author. The photographs showed only eight lines. These are not correctly interpreted at their face value; they lead to a unit with $a_0 = 5.4$ Å, a fact which is overlooked. Instead, a_0 is taken to be 7.62 Å, and the possible atomic arrangements are discussed at length, one finally being accepted as satisfactory, despite very pronounced disagreement between observed and calculated intensities of the lines. (This structure is described elsewhere (p. 553) as representing a new class of chemical combination, of which it is the sole representative.) As could be expected, the results are all wrong; a better powder photograph leads to the value $a_0 = 10.8$ Å and a completely different atomic arrangement.

Although this book can hardly provide the student with a sound basis for independent work on the determination of the structure of crystals, certain portions of it may be found useful. Some of the sections, such as Chapter VII, on the rotating-crystal method, are brief and clear and provide good presentations of their topics. The book contains many excellent drawings.

LINUS PAULING

CALIFORNIA INSTITUTE OF TECHNOLOGY

TIMBERS OF NORTH AMERICA

Identification of Commercial Timbers of the United States. By H. P. BROWN and A. J. PANSHIN. McGraw-Hill Book Co., Inc., New York. Pp. 223, illus. 1934. $3.00.

THIS is the first of the books to be published as the American Forestry Series, of which Professor Walter Mulford, head of the division of forestry of the University of California, is consulting editor. It is fitting that such a series, which eventually is to deal with all phases of forestry, should be introduced by a book on the identification of wood, the chief product of the forest. It is stated in the preface that the primary objective of the book is to give information for the accurate identification of our commercial timbers and that a second text covering the general field of wood technology is planned.

The first part of the book deals with wood structure, which is the chief basis for wood identification. The text begins with a description of the coarser structural features, such as the annual rings, sapwood and heartwood, and proceeds toward the finer elements.

The structural characteristics are supplemented by such physical characteristics as color, odor, taste, weight and hardness, which in general are less specific or more difficult to describe than structural features.

The portion of the text dealing with the minute structure of wood is of necessity couched in technical language, but, like everything else, when once mastered it no longer seems so formidable.

Two keys by means of which a piece of wood may be traced down and identified are given. One is based on gross characteristics visible with the unaided eye or hand lens; the other is based on microscopic characteristics. The authors are of the opinion that for teaching purposes at least it is better to keep the two separate.

The keys are followed by detailed supplemental descriptions of each wood, which are an aid in identification.

An outstanding feature of the book is the numerous excellent reproductions of photomicrographs which it contains. There are plate figures of cross sections of 90 species of wood magnified 5 times, and of cross and tangential sections of 84 species magnified 75 times. In addition the book contains illustrations of special structural features magnified 250 times for the most part, and some text figures.

Identification of the Timbers of Temperate North America. By SAMUEL J. RECORD, John Wiley and Sons, New York. 196 illus., 1934. $3.00.

THIS is a revision of the author's "Identification of the Economic Woods of the United States," first published in 1912 with Part I, which deals with the discussion of wood structure, enlarged so as to cover the anatomical features found in tropical woods as well as in those of temperate climates. The anatomical terms and definitions used are in conformity with those recently adopted by the International Association of Wood Anatomists ("Tropical Woods," December 1, 1933) after protracted work by the Committee on Nomenclature, of which Professor Record is the chairman.

Several pages are devoted to the origin and development of the primary and secondary tissues, which makes the book considerably better adapted for class work than the previous editions. A brief description of the formation of the secondary wall with its numerous modifications is given. A tertiary layer of the cell wall is no longer recognized by the author; spiral thickenings, gelatinous layers, etc., are considered a part of the secondary wall. The confusion which has prevailed among botanists as to the precise meaning of such terms as middle lamella, primary wall, secondary wall and tertiary wall is pointed out.

A new conception of a pit is brought out, namely,

that a pit is an entity of an individual cell, and two opposite pits of adjacent cells, hitherto referred to as a single pit, are called a "pit-pair."

Thirteen tables are given showing the occurrence or absence of certain structural characteristics in large numbers of families or genera. Thus one can see at a glance which families have scalariform perforations in the vessels, which genera have tyloses or gum deposits in the vessels or which dicotyledonous genera contain intercellular canals, etc.

Brief mention is made of some woods with anomalous structure, particularly those having phloem included within the xylem.

Only such physical properties as bear on identification are discussed, particularly color, scent, taste and density.

Part II is concerned primarily with the identification of the economic woods of the United States and Canada covering some 80 different kinds of woods. A comprehensive artificial key is presented in which the gross structure, as visible with the naked eye or hand lens, is given in text type, while the histological features visible only with a microscope are given in smaller type. The specific gravity is given for each species, which is a guide as to the relative weight and hardness of the wood.

In addition to the rather detailed or "descriptive" key there are supplementary notes on each species, containing short accounts of the size, distribution and relationships of the trees, and the properties, principal uses and commercial importance of the wood. References to further information are supplied for many of the species, and a general bibliography on wood is given. The text is supplemented by a map of the United States, showing the principal forest regions, and 30 photomicrographs, showing types of wood structure, and 47 text figures.

The reviewer wishes to dissent from the author's use of the terms "early wood" and "late wood" for the inner and outer parts of the annual ring, respectively. To the uninitiated it may not be clear that "early" and "late" refer to the growing season, and he may wonder why some wood should have been formed prematurely while some was tardy. That difficulty is largely removed when the terms spring wood and summer wood are used.

Very little is said about variations that occur in each species of wood, largely because the information does not exist. Wood technologists are recognizing more and more the need of study along that line, since, without knowledge of variation within a species, specific identification is risky or impossible in many cases.

ARTHUR KOEHLER

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REPORTS

THE NEW ENGLAND INTERCOLLEGIATE GEOLOGICAL EXCURSION

THE New England Intercollegiate Geological Excursion was held on October 12, 13 and 14, at Bates College, in Lewiston, Maine. Dr. Lloyd W. Fisher, head of the department of geology at Bates College, had charge of the trips illustrating minerals, rocks and structures, and was assisted by Dr. Edward H. Perkins, of Colby College, Waterville, Maine, who conducted all the glacial trips. Despite occasional rain, snow and hail and chilling winds, all the trips were run on scheduled time and all localities visited. At the evening meeting held in Carnegie Science Hall, on the Bates Campus, there were 72 people, representing 19 colleges, in attendance. Drs. Perkins and Fisher conducted the discussions relative to the points of interest visited on the trips, and an open forum was held following these discussions. The members of the association sent a telegram of greeting to Dr. Wilbur G. Foye, of Wesleyan University, who was unable to attend the meeting because of illness.

GLACIAL TRIPS

On Friday afternoon Dr. Perkins led his group over the plain of the Little Androscoggin River, and topographic features of the plain and wind-drifted sands were studied. Several underfit streams were examined. It was suggested that the flat floor of the valleys represented the clay level and the valley walls represented the sand, which was more easily eroded. In one case clay was found in the walls. Gravel terraces of Bog Brook were believed to be formed by a rapidly flowing stream between valley walls and ice walls. Disturbed strata in the outer portion of the deposit indicate some movement of the ice. West of Welchville, Dr. Ernst Antevs pointed out till rising from the sand plain. The contact between the sand and the till is believed to represent the upper marine level at an elevation of about 350 feet, corresponding with delta surfaces east of Lewiston. A gravel ridge south of Poland village, near Lower Range Pond, represents either a true esker, or crevasse filling. No definite conclusion was reached.

The party continued southward to the village of Gray, where kame topography was crossed. Gravel and till terraces occur to the north of the village. The feature of greatest interest was the great kettle-hole to the east of Gray. This kettle stands in a broad sand and gravel plain that extends several miles to the south. The plain is formed of stratified materials

and was probably built to the marine limit of 300 feet. There was some discussion as to why no marine clay was found, and it was suggested that the sea was at its upper limit a very short time and that during this time the hole was filled with ice.

The party continued on to Lewiston, studying some marine clays en route. On Saturday morning the glacial party stopped at a pit in Auburn. Evidence here indicated the following: Deposition of cross-bedded sands near the ice front; deformation of the deposits by local ice movements; dropping of masses of till into the sand and gravel. The retreat of the ice was followed by marine deposition, during which several feet of marine clay were laid down. The upper and younger beds were believed to be loess deposited on the exposed surface after the retreat of the sea. The source of the material in the loess was probably the exposed mud-flats left over the valley as the sea receded.

Following the Androscoggin River southeastward, the party noted erosional features. At the village of Durham a stop was made on the elevated kame surface, which seems to be of glacial origin and might have served as a dam, causing the river to swing northward. It was suggested by Goldthwait that the deposits might have been formed in an enclosed basin with ice walls on all sides and built up to the water level of the basin. This level might or might not agree with that of the sea outside. If surrounding ice was tight it might maintain its own water level some distance above sea level of the time.

Only a brief stop was made at the famous kettle-bottom, because of the present "glacial" climate. The opinion seemed to be that the ice-contact margin went all around the kettle-bottom, which allowed the deposit to build up to water level in an ice-locked basin. A block of ice in the center of the basin was responsible for the kettle.

Delta structures south of Sabattus Lake were studied, and a stop was made in a pit near the margin of the deposits where very coarse ice-front deposits were examined. An esker here ends in a complex of kame ridges merging into the delta. Again the question arose as to whether the esker was formed in a tunnel or an open crevasse. Again, as usual, the question was unsettled.

On Saturday afternoon the large gravel deposit just west of Leeds on Maine Highway 100 was visited. The southern slope is too gentle to be an ice contact, and is believed to represent a deposit at a free edge. The northern slope appears to contain a buried esker which projected above the general surface. The deposits showed ice contacts north and east, which are probably deltas. East of the delta the country is rolling and is covered by an unknown thickness of clay, which is exposed in an old brickyard near Leeds Junction. Goldthwait is of the opinion that the ice stagnated in places and was covered with sea water in which clay was deposited. As the ice melted the clay was lowered in an irregular manner, producing hummocky topography. Another theory stated that the clay cover was thin and mantled a buried pre-marine topography, which was reflected in the present surface.

On the road east of Sabattus Lake, another steep-sided gravel plateau was noted. Ice-contact slopes appeared to extend on all sides which are visible from the road. It may represent a delta or an ice-locked deposit. The final stop was made at an elevated gravel mass southeast of Sabattus Lake on Highways 9 and 126. Fresh pits showed cross-bedded sands under well-developed foreset and topset beds. Ice-contact slopes of very coarse material are found on the northwest and northeastern sides of the deposits, while foreset dips down the valley to the south. All agreed that the deposit was a delta built in a bay in the front of an ice tongue which filled the valley to this point.

On Sunday, Dr. Perkins led another group of glacial geologists northward from Lewiston, visiting the typical marine clays of the Kennebec valley near Gardiner; an esker buried by marine clays in the City Pit of Augusta; delta and related deposits in the northern part of the town of Augusta. The delta here is one of a series along the Belgrade esker. Two new cuts showed topsets and foresets dipping toward the delta front. A short trip was made over the esker. A pit in the esker at Horse Point, Belgrade, revealed some marine fossils. In Waterville, stratified gravels and marine clays pass over the top of the esker in the Drummond Avenue pit. The clays are full of fossils, 16 species having been found here. These deposits are without doubt post-esker age and thus represent a clay distinct from that of Horse Point. Esker deposition, subaerial erosion, marine clays resting on the unconformity, gravels and sands, partly wind-blown on the clay, were noted in the Waterville City Pit.

Mineral, Rock and Structure Trips

The Friday morning trip was made to a newly opened granite quarry along the Mechanic Falls-Welchville road. Several small basic dikes show small offsets; one large basic dike appears to have been reopened and reinjected. Faintly perceptible banding in the granite might be due to flow or to weak metamorphism. A coarse pegmatite veinlet yielded some excellent feldspar crystals.

On the return to Lewiston the Keith pegmatite quarry, from which many beautiful clear-colored tourmalines have been extracted, was visited. A

search was made here for radioactive minerals in an effort to secure enough material for an age relationship. Near the basic dike which cuts through the pegmatite the feldspars become more albitic and seem to be more prolific in their gem-bearing nature.

The abandoned Franklin quarry, in Auburn, Maine, shows the pegmatite invading a limy rock, which is conceded to be an equivalent of the Lewiston limestone. Here also is an interesting development of hornblende and tourmaline along the walls of a large fracture and in the rock mass.

The Friday afternoon trip began by making a cursory study of famous old Mt. Apatite, in the town of Auburn. Dr. Fisher pointed out the most interesting features of the quarry, and the party visited practically all the numerous pits in this interesting locality. Of special interest are the very large massive development of lepidolite, the development of large garnets in zones, the baked contacts of the basic dikes in the pegmatite, and the small amount of contact minerals developed in the invaded country rock. Considerable time was spent in picking over the dumps and many interesting and beautiful mineral finds were made.

From Mt. Apatite the party proceeded to the Rapids of the Androscoggin, between Lewiston and Auburn, and here a pegmatite sill, intruded into metamorphics, forms the lip of the falls; a basic dike shows twisting and faulting; numerous well-developed potholes were found in the gneiss and pegmatite alike.

The next stop was made at the City Quarry, in Lewiston, where the Lewiston limestone, slightly metamorphosed, is invaded by pegmatite dikes and by at least 16 melanocratic dikes. Some of the latter show chilled and baked contacts and others do not. One or two of the basic dikes show slight displacement. The age of these dikes is in question, and again attempts were made to find samples that might be used for age determinations. In the Lewiston limestone, Dr. Fisher pointed out numerous bands of biotitic and hornblendic material, which represents schistose and gneissoid material formed from impure bands of limestone. It was further pointed out that the problem of the age of the Lewiston limestone, the invading pegmatites and tourmaline granites and the melanocratic dikes will probably have to be settled from the relationships between these rocks in the City Quarry. The melanocratic dikes are the youngest and might be Triassic or Keweenawan, but it was also suggested that, since igneous activity occurred in Maine in Silurian and Devonian time, these dikes might be connected with that activity. If the dikes are Triassic, the limestone might range anywhere from Grenville to Carboniferous; if Keweenawan, the limestone would have to be Grenville, at least, pre-Cambrian.

Leaving the City Quarry, the party was shown outcrops whose structure is in question. One of these, at the Wiseman farm, east of Lewiston, shows the metamorphosed equivalent of the Lewiston limestone, the Thornerag member, slightly folded. It was conceded by some to represent a push by the invading pegmatite; others believed it to represent actual folding. Nearby an overturned anticline was noted in a roadside exposure. A slight hail and snow storm disturbed the party here, and the return to Lewiston was begun.

On Saturday morning the trip was conducted in such a manner as to show a cross section of rock types. A coarse-grained granite was visited on Hedgehog Hill, northeast of Lewiston, and southeast of it a granite gneiss was studied. A short distance from the latter is a gneiss, definitely of sedimentary origin. The theory was advanced that the gneiss between the one of sedimentary origin and the granite represents an assimilated country rock which was later metamorphosed.

Going westward from the latter area an interesting pegmatite was studied. It showed large feldspar plates that are apparently well oriented, as though by pressure.

Unaltered limestone was studied near Sabattus, about six miles from the type locality in the City Quarry. Southeastward of Sabattus, along Route 9 toward Webster, an interesting outcrop shows metamorphosed limestone now occurring either as a gneiss with a strong development of pyroxenes, and a much more finely laminated metamorphic which can be called a schist. The gneiss is termed the Thornerag formation, and the schist, the Sabattus schist. Both are members of the Lewiston limestone series, which shows different degrees of metamorphism. Pegmatite lit-par-lit invasions in this outcrop render the problem more difficult. Heavy rain at this particular stop prevented much thorough discussion.

The Sabattus schist at Mann Hill, east of Sabattus, controls the topographic features of the immediate vicinity. It is fractured, and along the fractures coarse-grained granite has been intruded. Some disturbance occurred after the invasion of pegmatite veinlets, for these are faulted and stretched out and broken. From the study made at this point it is believed that there are at least three different stages of pegmatite invasions in the Lewiston area.

The party returned to Lewiston and, meeting with the glacial party, enjoyed the warmth of the fireplace of Thornerag cabin, where hot coffee was prepared by members of the Bates College Outing Club.

In the afternoon a large group visited the now famous topaz locality—the Fisher mine—near Topsham, and collected numerous attractive specimens. On Sunday six cars of visitors were taken westward

to beyond Hebron, Maine, where collecting was indulged in at the pit formerly operated by the General Electric Company for pollucite.

The name Lewiston limestone was proposed by Dr. Fisher for the limestone occurring at the City Quarry in Lewiston. He also proposed calling two definitely distinguishable metamorphosed phases of it the Thornerag gneiss and the Sabattus schist. Another member of the series, the Hill Ridge biotite gneiss and schist, was not included in the itinerary. The age of the pegmatites, so common in the area, might be ascertained from the study of included radioactive minerals or from the age of the Hedgehog Hill granite. Dr. O'Connell suggested that the Lewiston series might be more or less analogous to the Inwood limestone, Manhattan schist and Fordham gneiss, but until definite age relationships are established for the Lewiston rocks no definite correlations will be made.

No definite meeting place for next year has been decided on. The group has been invited to visit several localities in New Hampshire and in and around New York and Long Island.

LLOYD W. FISHER

BATES COLLEGE

SCIENTIFIC APPARATUS AND LABORATORY METHODS

AN ELECTRICALLY-HEATED SLIDE-RINGING DEVICE

IN preparing permanent slides of material mounted in lacto-phenol or other non-hardening medium, it is customary to use a suitable cement to fix the cover slip firmly to the slide. A satisfactory cement is Noyer's, which consists of 80 per cent. rosin and 20 per cent. anhydrous lanolin and is described in Langeron's "Précis de Microscopie." Ordinarily this cement is applied to the cover slip by means of a small coil of wire which has been heated in the Bunsen flame, dipped in the cement and subsequently applied to the slide. In using this method one tends to overheat the wire coil in an attempt to retain enough of the cement in the coil to deposit a complete ring around the slide with one application. There is, in consequence, uneven heating, frequent burning of the cement and the production of acrid smoke.

It is the purpose of this account to describe briefly an electrical heating device which maintains a constant and satisfactory temperature and greatly facilitates slide ringing by this method.

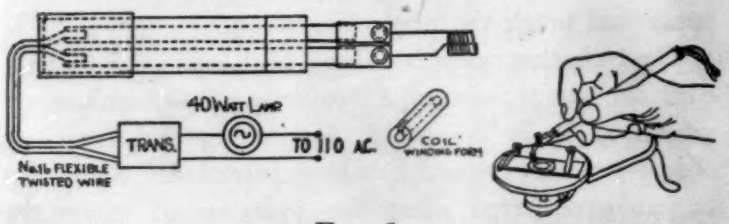

FIG. 1

The device consists of a heating coil held in a convenient handle by which it can be manipulated. The general character can easily be understood from the accompanying illustration. It consists of two insulated brass rods in a fiber tube with No. 16 flexible twisted wire soldered to the rods at one end and the other end bearing set screw connections to which is attached a small heating coil of No. 21 nichrome wire. To make the heating coil, a piece of wire approximately 7 inches in length is wound as follows: A right angle bend is made in the wire at a distance of about 1¼ inches from one end. This is inserted in a brass tube ⅛ inch external diameter and 1/16 inch internal diameter, with a small slot cut in the end of the tube. The long end is fitted into the slot and a coil is wound closely on the outside of the tube until the remaining end is about one inch in length. The coil is then removed from the tube and the two free ends are firmly attached by tightening the set screws. The coil thus wound is compact and the windings are equally spaced. The ends attached at the set screws are then bent at approximately a right angle to facilitate using the device.

The proper temperature is obtained by passing a current of about 5 amperes through the coil, which heats it to a dull red. A convenient source of this is the transformer used for microscope illumination. This transformer, however, with its primary input of 110 volts, 60 cycles, A.C., has an output of 18 amperes at 6 volts which is excessive, but can easily be brought to the proper intensity by placing a 40-Watt lamp in series with the primary of the transformer.

When the device is connected and pressed into the cement, the cement melts easily and enough is retained to deposit a sealing ring of cement around a cover slip of as much as ⅞ inch diameter. For circular slides a turn table has proved very satisfactory. The slides should be cleaned and seepage of the mounting fluid should be avoided. When lacto-phenol is used, this excess can be removed by a cotton swab moistened in 95 per cent. alcohol.

The device has also been found useful in affixing paraffin imbedded material to blocks for sectioning. The material is placed on the paraffin covered top of a block and the coil applied gently to the sides, until the paraffin melts sufficiently to affix the material to the block.

This coil retains sufficient cement to ring a slide with one application and the even heat obtained minimizes the smoke and avoids change in the com-

position of the cement. The raw materials including tools are easily obtained, the cost is very small and the device is easily made. It has been used with satisfactory results in this laboratory for the past year and it is hoped that it will be of service to others in ringing slides by this method.

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PRESERVATION OF SMALL AMPHIBIA IN GELATIN[1]

IT is difficult to retain the natural colors and appearance of frogs and salamanders by preserving the specimen simply in formalin or alcohol. The use of tubes of gelatin, described below, overcomes this difficulty and also makes a handy mount for identification purposes in the classroom. The gelatin mixture is a clear medium through which the external features of the specimen are clearly visible. Several successive stages in the life cycle of a given species may be replaced conveniently in one tube.

Procedure: The live specimen is killed and placed at once in 20 per cent. formalin. A slit in the abdomen of the larger specimens may be made to permit more ready penetration. After remaining in the formalin over night, the specimen is removed and washed in tap water eight hours. It is next placed in Kahle's fixative over night, then washed in running tap water ten hours. Kahle's fixative is:

95 per cent. alcohol	15 parts
40 per cent. formalin	6 "
Glacial acetic acid	2 "
Distilled water	30 "

Test-tubes of from 15 to 50 cc capacity are used, depending on the size of the specimen. The mounting medium is made as follows, using Difco Standardized Bacto Gelatin:

10 grams of purified gelatin
36 drops of formalin (40 per cent.)
100 grams of water.

Heat the water to boiling, add the gelatin and allow to dissolve. Add the formalin just before pouring the mixture into the tubes. In some cases good results are obtained by adding the formalin after the gelatin has been poured into the tubes and mixing thoroughly. When the tube feels moderately warm to the hand, place the specimen in the medium in the desired position, with tweezers, etc. Further cooling will stiffen the gelatin sufficiently to hold the specimen in position. After the specimen is satisfactorily oriented, the tube may be placed in a refrigerator to hasten gelation.

The tubes are later sealed with a mixture of equal parts of Parowax and sealing wax, and should be placed in a vertical position in a rack for safe storage.

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SPECIAL ARTICLES

TRANSMISSION OF INFLUENZA BY A FILTERABLE VIRUS

THE studies of Shope[1] on swine influenza established the fact that a filterable virus is the essential factor in the production and transmission of the disease. In 1933, Smith, Andrewes and Laidlaw[2] reported that the intranasal inoculation of ferrets with nasal or pharyngeal washings from human cases of epidemic influenza produced a disease in those animals characterized by fever and catarrhal swelling of the nasal mucous membranes, but without detectable pathological lesions in the viscera. They were able to transfer the disease in ferrets by the intranasal inoculation of suspensions of the ground turbinate bones. The causative agent was found to be a filterable virus. The animals invariably recovered from the disease, and the serum of a recovered animal was found to neutralize the action of the virus. They were also able to produce a similar disease in ferrets with the virus of swine influenza. Shope[3] was able to confirm their observations on the infectivity of the virus of swine influenza for ferrets. He observed, however, that when the ferrets were inoculated intranasally under light ether anesthesia, pulmonary consolidation was an invariable accompaniment of the disease, the infection was more severe, and death of the animal sometimes occurred. Suspensions of the lungs of infected animals were found to contain a high concentration of the virus.

Last winter a number of ferrets were inoculated in this laboratory with material from various respiratory infections, including common colds, acute tonsilitis, lobar pneumonia, psittacosis and two cases of clinical influenza. In only one instance, and that distinctly of bacterial origin, was infection established in the ferret.

During the latter part of August and September of 1934, an epidemic of respiratory infection occurred in Puerto Rico. In its clinical course it appeared to be typical epidemic influenza, although the mortality was low. On September 10, 1934, through the kindness of Drs. W. C. Earle and W. A. Sawyer, of the

[1] The basis of this method was obtained from C. W. Hargleson's article in Scientific Notes, *Jour. Econ. Ent.*, Vol. 25, p. 936.

[1] Richard E. Shope, *Jour. Exp. Med.*, 54: 373, 1931.
[2] W. Smith, C. H. Andrewes and P. P. Laidlaw, *Lancet*, 66, 1933.

[3] Richard E. Shope, *Jour. Exp. Med.*, 60: 49, 1934.

International Health Board, specimens of sputum in 50 per cent. glycerine, from 5 typical cases, were received. Three of the specimens were separated from the glycerine, washed and emulsified in Locke's solution. The material from each of these 3 cases was then inoculated intranasally into ferrets under ether anesthesia. On the second day after inoculation, each of the animals had an abrupt rise of temperature, which in one instance reached 106.5° F. The latter animal (P. R. 5) was sacrificed on the third day after inoculation; the lungs and turbinates were removed and ground with sand and meat infusion broth. Two animals were then inoculated intranasally with unfiltered suspensions and one with a Berkefeld V filtrate of the material. All 3 animals developed fever in from 24 to 48 hours, and, since that time, consecutive serial passages have been made in ferrets at 4 to 5 day intervals, with 5 per cent. broth suspensions of ferret lung tissue or with Berkefeld filtrates of the suspensions. In the sixth passage animal, pulmonary consolidation, bluish-red in color, was observed in the lower lobe of the left lung. In subsequent animals inoculated with either filtered or bacteria-free unfiltered material, the pulmonary lesions have been more extensive and have been consistently present through the twelfth passage. The subcutaneous injection of suspensions of lungs containing the infectious agent has elicited no evidence of the experimental disease.

In the course of the experimental work with ferrets, one of the laboratory workers (S. S.) developed symptoms typical of influenza. Nasal and pharyngeal washings inoculated intranasally induced the disease in a ferret without producing pulmonary consolidation. This strain was also transmissible from animal to animal with bacteria-free material.

The onset of fever in the animals occurs generally on the second day after inoculation. There is usually moderate apathy, lack of appetite and pallor of the nose. The catarrhal symptoms have been extremely variable. In animals with pulmonary consolidation, rapid, labored breathing and cough occur. Following the first fever, the temperature usually drops to normal and then rises again in from 24 to 48 hours. The course of the fever is not uniform. There have been no fatalities in the animals infected with the original strain which were allowed to run the entire course of the disease.

Grossly, the pulmonary involvement is usually of lobar distribution. The lung is bluish red in color. When cut, considerable moisture exudes from the tissue. The microscopical study of the involved lung of the ferret reveals a thickening of the alveolar walls with proliferation of the alveolar epithelial cells. The alveolar spaces contain, predominantly, large pink-staining cells resembling the alveolar phagocytes, many of which show degenerative changes. Polymorphonuclear leukocytes are not numerous except in the terminal bronchioles. There is also a pronounced perivascular round cell infiltration. Fibrin is scanty, but definite edema is present. The picture closely resembles the description by Shope[4] of swine influenza in ferrets. It differs strikingly from the acute bacterial infections of the lung, but is not unlike the pulmonary lesions produced by pure virus infections, such as psittacosis in the monkey.[5]

The present results confirm the observations of Smith, Andrewes and Laidlaw[6] on the transfer of a filterable, transmissible agent from human cases of epidemic influenza to ferrets. The character of the disease in the ferret differs from that described by the British authors, in that it is more severe and is accompanied by pulmonary consolidation. In these respects, the disease in our animals appears to resemble more closely the disease produced in ferrets by Shope, with swine influenza virus. There has been evidence to suggest the adaptation of the virus to the ferret, for with strain P. R. 5 distinct pulmonary lesions were first noted in the sixth passage animal.

A Berkefeld V filtrate of the sputum obtained from Puerto Rico (P. R. 5) was inoculated into 6 Swiss mice intracerebrally and intraperitoneally under ether anesthesia. Berkefeld V filtrates of suspensions of the lungs of the first and the fourth passage ferrets, administered to Swiss and white-faced mice by the intranasal, intracerebral and intraperitoneal routes, caused no demonstrable effect. In each instance the mice originally inoculated were sacrificed and passages made to new mice by the same routes.

On September 21, the centrifuged but *unfiltered* lung suspension from the second passage ferret of the contact strain (S. S.) was inoculated into 3 white-faced and 3 Swiss mice by the intracerebral, intranasal and intraperitoneal routes. One of the white-faced mice died in 24 hours with generalized bacterial infection. On the second day, several of the mice appeared to be somewhat sick, and all were killed on the fourth day. No abnormalities were found. The lungs were ground with 20 cc of Locke's solution, centrifuged, and 4 Swiss mice inoculated intranasally and intracerebrally. On the fourth day, when killed, consolidation of the upper portions of the lungs was found in 2 mice. Suspensions from these two lungs were given to 6 Swiss and 6 Rockefeller Institute mice intranasally. Several of the Swiss mice ap-

[4] *Ibid.*

[5] T. M. Rivers and G. P. Berry, *Jour. Exp. Med.*, 54: 129, 1931.

[6] *Op. cit.*

peared ill, and 4 of the 6 had definite pulmonary lesions at autopsy on the fourth day. None of the mice of the Rockefeller Institute strain showed pulmonary involvement.

In the fifth passage, death of all 6 Swiss mice and of 2 of 6 of the Rockefeller Institute strain occurred in 48 hours. The surviving mice were killed. All showed extensive pulmonary consolidation involving most of the left lung and cardiac lobe, and usually part of the right upper and middle lobes. A Berkefeld V filtrate of a 10 per cent. lung suspension was then inoculated intranasally into 6 Swiss mice. This filtrate was found to be bacteriologically sterile in both aerobic and anaerobic cultures. Death occurred in these mice in from 48 to 72 hours, all animals showing marked pulmonary consolidation.

Subsequently, the inoculation of a 5 per cent. lung suspension, or Berkefeld V filtrates of from 5 to 10 per cent. suspensions of lung, caused death in Swiss mice in about 48 hours. Mice of the Rockefeller Institute strain survived somewhat longer. In practically all instances, direct cultures of the heart's blood and of the cut lung surface have been free from bacteria. Cultures of the emulsified tissue in blood broth not infrequently reveal various Gram-negative bacilli, but they are usually few in number. These bacteria do not appear to be related to the disease process, since they are inconstantly observed. Furthermore, subsequent bacteria-free emulsions or filtrates have been fully active.

This strain of infective agent (S. S.) has been passed through 11 series of mice. A suspension of the lungs from mice of the eighth serial passage inoculated intranasally into a ferret produced a characteristic febrile reaction. At the same time, different dilutions of the mouse lung suspension were made, and a small amount of each dilution was inoculated intranasally into 4 mice. By the seventh day all animals receiving a 1:1600 dilution, or more, had succumbed with typical pathology.

More recently, an unfiltered sterile lung suspension of a ferret, the tenth passage animal of the original Puerto Rico passage strain (P. R. 5) was transferred to mice. In the first mice, killed on the fourth day, only mild pulmonary lesions were seen. In the second passage, however, all died on the fourth day with typical extensive involvement. The mice of the third passage, which received a bacteria-free 10 per cent. suspension of lung, died in 48 hours. These results are of special interest, since earlier attempts to transmit infection to mice with filtrates containing this strain were unsuccessful.

The lesions in the mouse's lung tend to involve the entire lobe, spreading peripherally. The surface is smooth and bluish gray or reddish blue. When the trachea is cut, a copious foamy liquid exudes. The cut surface of the lung is rather viscid, but firm. Stained films usually reveal mononuclear cells, but no bacteria. Microscopically, there is thickening of the alveolar walls and a moderate amount of edema in the alveolar spaces. The degree of hyperemia is variable. There is a perivascular small round cell infiltration. The cellular reaction, unlike acute bacterial infections, is predominantly of the mononuclear cells. The number of polymorphonuclear leukocytes varies. In many of the cells degenerative changes are seen in the nuclei and protoplasm.

The results of the experiments, both in ferrets and mice, indicate that the agent producing the disease in these animals is a filterable virus. It has been possible to produce the infection with filtrates, which, in aerobic and anaerobic cultures, are bacteriologically sterile. The pulmonary lesions are bacteria-free. Furthermore, the microscopic pathology of the involved lung resembles that of pulmonary lesions produced by other virus infections, rather than that of bacterial infections.

In the current issue of *The Lancet*, Andrewes, Laidlaw and Smith[7] report their success in transmitting to mice the viruses derived from both swine influenza and human influenza. The results in the present study are apparently in complete agreement with theirs. They have been able, in addition, by the use of specific antiserum from hyperimmune animals (horse and ferret), to neutralize the action of the respective viruses in mice.

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GLUTAMINE IN THE TOMATO PLANT[1]

ALTHOUGH the amide glutamine is probably widely distributed in nature,[2] very few direct attempts have been made, since its first isolation by Schulze and Bosshard,[3] to study the function of this substance in the metabolism of the plant. The lower homologue, asparagine, on the other hand, has received a great deal of attention. The hypothesis has been advanced by Prianischnikow[4] that asparagine is synthesized in the plant in response to an accumulation of ammonia from any cause. The reaction is regarded as a detoxification of the ammonia by conversion into a

[7] C. H. Andrewes, P. P. Laidlaw and W. Smith, *Lancet*, 2: 859, 1934.

[1] A part of the expense of this investigation was shared by the Connecticut Agricultural Experiment Station and the Carnegie Institution of Washington. Dr. Clark is the holder of a National Research Council fellowship, 1933–34.

[2] A. Stieger, *Ztschr. f. physiol. Chem.*, 86: 245, 1913.

[3] E. Schulze and E. Bosshard, *Ber.*, 16: 312, 1883.

[4] D. Prianischnikow, *Biochem. Ztschr.*, 150: 407, 1924.

neutral compound that can be translocated and stored in readiness for subsequent syntheses in which nitrogen is required. Prianischnikow[5] has pointed out, however, that certain species, especially the oil seeds, store glutamine instead and, in fact, regards glutamine and asparagine as physiologically equivalent to each other.

The culture experiments on which this generalization was founded were carried out with young seedlings. Support for the view that asparagine fulfils an analogous function in the *mature* plant has been obtained from the experiments of Mothes[6] with a number of species, and of Vickery, Pucher, Wakeman and Leavenworth[7] on the leaf of the tobacco plant. The present experiments show that glutamine is formed in considerable amounts in tomato plants when these are grown in solutions that provide ammonia as the sole source of nitrogen; the inference may therefore be drawn that this amide can likewise be employed by a mature plant for the purpose of detoxifying ammonia.

Tomato plants, 36 days old, of the Marglobe variety, were transferred to sand cultures and grown for 41 days with continuous renewal of culture solution. Two different solutions were employed; both were based on Tottingham's solution, but one included calcium nitrate as a source of nitrogen, the other ammonium sulfate. Both solutions were adjusted to pH 6.7 and to a total osmotic pressure of approximately one atmosphere, of which 0.3 was supplied by the nitrogen-containing salt.

At the termination of the experiment, the tops of 11 plants from each culture were dried in a rapid stream of air heated to 80° C., and 11 plants from each were extracted with boiling water, as described by Vickery and Pucher.[8] Determinations of the ammonia in the dried tissue, and in the hot-water extract therefrom, drew attention to the presence of a substance that was decomposed with the production of considerable quantities of ammonia during the process of preparing the water extract. The dried tissue was therefore investigated for glutamine.

The ammonia nitrogen was determined by distillation of 0.2, or 0.4 gm of the dry powder, in the presence of 10 cc of a 12.5 per cent. suspension of light magnesium oxide and 25 cc of water, for 15 minutes at 40° *in vacuo*. The distillate was Nesslerized and read either in a colorimeter or a Pulfrich photometer against suitable standards.

[5] D. Prianischnikow, *Ber. deut. botan. Ges.*, 40: 242, 1922.

[6] K. Mothes, *Planta*, 1: 472, 1926.

[7] H. B. Vickery, G. W. Pucher, A. J. Wakeman and C. S. Leavenworth, *Carnegie Institution of Washington, Pub.* 445, 1933.

[8] H. B. Vickery and G. W. Pucher, SCIENCE, 73: 397, 1931.

The glutamine amide nitrogen was determined according to a slight modification of the method of Chibnall and Westall,[9] in which a 0.2 gm sample of the tissue was suspended in 10 cc of phosphate-borate buffer at pH 7.0 and heated in a boiling water bath for 2 hours to hydrolyze the amide. The suspension was then cooled, 2 cc of normal sodium hydroxide, 10 cc of magnesium oxide suspension, and 20 cc of water were added, and the mixture was distilled at 40° as before. The increase in ammonia brought about by the hydrolysis was taken to represent the glutamine amide nitrogen. Data in support of the accuracy of this method to determine glutamine will be submitted in a later joint publication from this laboratory and that of Professor Chibnall.

The results of the analyses are expressed in Table 1 in milligrams of nitrogen per 11 plants. It is strikingly clear that glutamine had accumulated in the plants grown on ammonia, particularly in the stems, to a far greater extent than in those grown on nitrate, notwithstanding the fact that the latter plants were much larger and more fully developed. The glutamine amide nitrogen made up over 15 per cent. of the soluble nitrogen in the stems of the plants grown on ammonia, the corresponding figure for the stems of the plants grown on nitrate being only 1.9 per cent.

TABLE 1

MILLIGRAMS OF NITROGEN AS AMMONIA, AND AS THE AMIDE NITROGEN OF GLUTAMINE, IN 11 TOMATO PLANTS

	Ammonia	Glutamine amide	Total soluble
Leaves, ammonia culture	101	63	913
Stems, " "	120	213	1,390
Leaves, nitrate culture	41	25	1,943
Stems, " "	52	70	3,654

Considerable interest attaches to the fact that glutamine accumulated mostly in the stems. The question of the location in the plant at which amide synthesis actually took place is clearly raised. If the synthesis occurred in the roots, does the high concentration in the stem represent an elaborated form of nitrogen undergoing translocation to the leaves and growing points, there to be used for further syntheses? On the other hand, if the glutamine was synthesized in the leaves from ammonia transported from the roots, is the high concentration in the stem an evidence of storage? Problems such as these still await experimental attack.

The identity of the amide in the tomato plant tissue

[9] A. C. Chibnall and R. G. Westall, *Biochem. Jour.*, 26: 122, 1932.

was established by direct isolation. To this end, 5,794 gm of tops of tomato plants, the greater part of which had been grown in sand culture supplied with ammonium sulfate as a source of nitrogen, were treated with ether to plasmolyze the cells, according to the method of Chibnall,[10] and the vacuole content was expressed at the hydraulic press. The press residue was then ground to a pulp and pressed again. The extract measured approximately 5 liters and was treated with an excess of basic lead acetate. The filtrate from the precipitate produced contained 726 mg of amide nitrogen (hydrolysis with 2 *N* sulfuric acid for 4 hours at boiling temperature).

The procedure of Schulze and Bosshard for the isolation of glutamine was then followed. This consists in precipitating the amides with mercuric nitrate from neutral solution. The precipitate is decomposed with hydrogen sulfide and the resulting solution, after being freed from hydrogen sulfide by distillation *in vacuo* for a short time, is neutralized with ammonia and concentrated at a low temperature to crystallization. The crude crystals so obtained were treated with norit in warm concentrated aqueous solution, and crystallization was brought about by the addition of alcohol. The glutamine then separated in tiny colorless needles, which weighed 4.78 gm. The preparation contained 18.94 per cent. nitrogen (theory 19.18 per cent.), 9.60 per cent. amide nitrogen (theory 9.59 per cent.) and yielded gas equivalent to 18.13 per cent. of nitrogen in the Van Slyke amino nitrogen apparatus. It is characteristic of glutamine to yield practically all its nitrogen under these conditions. The substance decomposed at 180° to 181°. The copper compound, prepared by boiling an aqueous solution of a sample for a few moments with an excess of cupric hydroxide, contained 15.56 per cent. of nitrogen (theory 15.84) and 17.94 per cent. of copper (theory 17.97 per cent.). The yield of recrystallized glutamine accounted for 63 per cent. of the total amide nitrogen in the filtrate from the basic lead acetate precipitate.

The mother liquor from the crude glutamine crystallization, on evaporation and treatment with alcohol, yielded several successive crops of crystals from which 0.44 gm of asparagine (water of crystallization 11.93 per cent., theory 12.00 per cent.; nitrogen 18.42 per cent.; theory 18.66 per cent.) was isolated; this is the equivalent of 5.6 per cent. of the original amide nitrogen. The mother liquors were collected and boiled with hydrochloric acid; glutamic acid hydrochloride weighing 0.53 gm, of melting point 198° to 199° and unchanged on admixture with authentic material, was then isolated. This, calculated as glutamine, accounts for a further 5.5 per cent. of the amide nitrogen of the extract. In all, 74 per cent. of the amide nitrogen was accounted for as crystalline products of demonstrated purity.

It is clear from these experiments that the marked increase in amide nitrogen brought about by culturing tomato plants in a solution that provides ammonia as the sole source of nitrogen is obviously due to an accumulation of glutamine in the tissue; asparagine, although present, plays an entirely subordinate rôle from the quantitative point of view.

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OVULATION IN THE DOMESTIC HEN[1]

INFORMATION regarding the act of ovulation in the domestic hen seems to be largely of a speculative nature. We were able in this study to observe the act of ovulation and to secure detailed records of the progress of the egg through the oviduct. Patterson[2] quoted Coste's[3] statement that the infundibulum actually clasped the follicle before ovulation and that the pressure exerted was probably a causative factor in ovulation. Patterson stated that he was able to confirm Coste's findings but supplied no details regarding his observations.

We first made a number of autopsies upon birds for which the laying had been carefully timed. By the autopsies it was possible to determine relatively accurately the time relationship between ovulation and the expulsion of the previous egg. The results indicated that ovulation usually occurred within an hour after laying.

In order to be able to witness the act of ovulation, we anesthetized birds as soon as possible after laying. Ether has usually been found unsatisfactory as an anesthetic for birds because of the retention of it in the air sacs. Nembutal (Pentobarbital sodium, 1 gr. per cc) proved effective for observations covering periods of several hours when injected into the circulation by way of the vena humeri profunda. From ½ to ¾ cc, depending upon the size of the bird, was used for the initial injection. It was found necessary to repeat the injections at intervals from one half to two hours. Occasionally a bird would die immediately following an injection, but otherwise the results with this anesthetic were very satisfactory.

All reported observations were made upon Single Comb White Leghorn hens. Ovulation was observed

[10] A. C. Chibnall, *Jour. Biol. Chem.*, 55: 333, 1923.

[1] Contribution No. 82 from the Department of Poultry Husbandry.

[2] J. Thomas Patterson, "Studies on the Early Development of the Hen's Egg. I. History of the Early Cleavage and of the Accessory Cleavage," *Jour. Morph.*, 21: 101–134, 1910.

[3] M. Coste, "Histoire du developpment des corps organises," Tome 1, Paris, 1874.

in eleven birds. The prospective birds were kept under close observation so that the exact time of laying could be recorded and then preparations were made for opening the body cavity as soon as possible. These preparations, including the anesthesia, required from 10 to 20 minutes. Four birds were found to have ovulated before the ovary could be exposed.

Of the eleven hens in which ovulation occurred under observation, only two had the infundibulum enclosing the ovum at the time of bursting of the theca. In two others, the ova were picked up immediately, indicating that the infundibulum and the follicle must have been very closely associated at the time of ovulation. In three cases, although the bird remained alive and apparently normal, the released ova were not picked up by the infundibulum. In the four other cases the infundibulum began to engulf the ovum within periods of 4 to 10 minutes after the rupture of the follicular membrane. In four birds, where the ovary was exposed within 14, 15, 18 and 20 minutes after laying the previous egg, ovulation had already occurred when the abdominal cavity was opened.

At the time of ovulation the blood vessels in the cephalic end of the oviduct were greatly congested. This portion of the oviduct was also very active. There was some indication of unusual enlargement of the blood vessels of the graffian follicle. Slightly in advance of the rupture of the follicular membrane the blood supply appeared to be reduced and there was a perceptible increase in the width of the stigma. The ovum to be released varied widely as to its position in the ovary.

The act of rupturing the follicular membrane was instantaneous. The released ovum was very much flattened and practically assumed the shape of the cavity into which it fell. In the first ovulation observed the ovum was so devoid of shape that the observers gained the impression that the vitelline membrane had been ruptured. The action of the infundibulum in engulfing the ovum seemed to be entirely random. It would partially engulf the ovum and then recede. The wave-like advances and recessions of the infundibulum sometimes occurred several times. The enclosing of the entire ovum may require as much as 30 minutes. When entirely enclosed the pressure exerted on the ovum by the musculature of the oviduct was very evident. In the infundibulum, where the progress of the egg was more rapid than elsewhere, the shape of the ovum was much distorted, sometimes being much elongated and at other times assuming dumb-bell shape.

Our observations would indicate that it is not necessary for the egg to be ovulated directly into the infundibulum. In fact most of the ovulations seen were not of this type. This study demonstrates that it is possible for the infundibulum to pick up the ovum after it has been released in the cavity about the ovary. In no case did the infundibulum appear to be exerting any pressure upon the follicle previous to ovulation. It is believed that the few cases where the infundibulum was around the ovum when released were purely chance situations, since the infundibulum is very active at this time and may be in contact with any part of the ovary. At times the infundibulum was seen to enclose partially the immature follicles.

In addition to making observations on the act of ovulation we were able also to secure practically complete time records of the passage of the egg down the oviduct for five birds. The positions of the egg were marked at 15-minute intervals by means of a shallow stitch taken in the wall of the oviduct immediately behind the egg. After the egg had traversed the length of the oviduct the organ was removed and records were made of the distances between stitches. Our observations do not fully agree with the statement made by previous workers as to the time required for egg formation in each portion of the oviduct. Earlier workers have depended entirely upon autopsies for their data. The average results from the five birds studied would indicate that the following were the periods spent by the egg in the various parts of the oviduct: Infundibulum—18 minutes; albumin secreting section—2 hours and 54 minutes; isthmus—1 hour and 14 minutes; uterus and vagina—20 hours and 40 minutes.

D. C. WARREN
H. M. SCOTT

KANSAS AGRICULTURAL EXPERIMENT STATION

BOOKS RECEIVED

BENTLEY, MADISON and E. V. COWDRY, Members of the Committee on Psychiatric Investigations, National Research Council. *The Problem of Mental Disorder.* Pp. x + 388. McGraw-Hill. $4.00.

GESELL, ARNOLD and HELEN THOMPSON. *Infant Behavior.* Pp. viii + 343. 33 figures. McGraw-Hill. $3.00.

GILCHRIST, DONALD B., Editor. *Doctoral Dissertations Accepted by American Universities, 1933–34.* No. 1. Pp. xiii + 98. H. W. Wilson. $1.00.

JOHNSTONE, JAMES. *Memorial Volume.* Pp. x + 343. Lancashire Sea-Fisheries Laboratory. University Press of Liverpool. 21 s.

JOOS, GEORG. *Theoretical Physics.* Pp. xxiii + 748. Illustrated. Stechert.

SIEGEL, MORRIS. *Constructive Eugenics and Rational Marriage.* Pp. xiii + 196. Illustrated. McClelland and Stewart, Toronto. $2.50.

TONGUE, HAROLD. *The Design and Construction of High Pressure Chemical Plant.* Pp. ix + 420. 307 figures. Van Nostrand. $12.00.

WHITE, HARVEY E. *Introduction to Atomic Spectra.* Pp. xii + 457. 100 illustrations. McGraw-Hill. $5.00.